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Essays on Central Bank Transparency, Accountability and Reputation

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Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

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Statement of Conjoint Work

I confirm that Chapter 3 was jointly co-authored with Cheryl Schonhardt-Bailey (London School of Economics) and James Sanders (Bank of England), and I contributed to 50% of this work.

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Abstract

The dissertation investigates determinants and effects of central bank transparency, particularly with respect to the role of communication in promoting the political accountability of monetary authorities. There has been much debate in both political science and economics concerning the desirability and effectiveness of communication within public organisations; however, the link among policy delegation, transparency and accountability remains little understood. The thesis examines this topic looking at different aspects of central bank transparency and how it interacts with the political environment in which monetary authorities operate.

In Chapter 2, I study the impact of legislative oversight on the transparency of the Federal Open Market Committee (FOMC). I develop a game-theoretical argument showing how, under reasonable assumptions, a monetary committee should prefer to communicate to political principals to signal competence rather than remaining silent; in this case, disclosures should also increase with political attention. Patterns of communication and transparency within the FOMC strongly support this expectation. Using methods from computational linguistics and features of parliamentary oversight of the Fed in US Congress, I find that the committee discloses additional information in its minutes when the legislative scrutiny of its decisions is likely to increase. In doing so, the study provides empirical evidence of a direct link between transparency and monetary committees' political accountability.

Chapter 3 (co-authored Cheryl Schonhardt-Bailey and James Sanders) examines dynamics of legislative oversight of economic policy within the UK parliament. Using several automated content analysis methods, the paper finds consistent differences in deliberative styles between monetary and fiscal policy, as well as across chambers (Commons, Lords). Parliamentarians appear more willing to engage in reciprocal exchange of arguments during monetary policy oversight that in the context of fiscal policy hearings. The paper also suggests some degree of cross-partisan agreement in challenging the officials of the Bank of England on issues related to governance and transparency, reinforcing the idea that these aspects of policy matter for accountability.

Chapter 4 investigates a different dimension of communication, namely the relationship between transparency and independence in promoting the credibility of monetary

authorities. In the study, I build on a Barro-Gordon framework to show that communication and central bank independence should be considered complementary policy instruments. I then test this argument using panel data for 95 countries in the period from 1998 to 2010. In line with expectations, I find that higher central bank transparency is associated with lower inflation, and that this effect is stronger for high levels of independence. Monetary delegation or transparency alone appear not to have a significant impact on prices, suggesting that the two policies interact.

Contents

Chapter 1

Introduction

The past few decades have seen delegation of policy functions in different areas of government, including financial stability, environmental regulation, and monetary policy. Several possible explanations for this process have been advanced (e.g., Stasavage 2003). Delegation increases gains from specialisation in technical policy areas. It can also be used to insulate long term decisions from the uncertainties of day-to-day partisan politics; this argument underpins the theoretical case for the establishment of independent central banks (Rogoff 1985). Delegation, however, raises questions about how to keep autonomous organisations accountable. Those who stress the need for greater accountability often underscore the importance of information transmission between the executive agencies, politicians and the broader public. The communication of public organisations allows elected representatives to monitor organisations' decisions (McCubbins, Noll, and Weingast 1987; 1989). Analysing agencies' transparency is therefore important for the study of their public accountability.

The dissertation examines the relationship between communication, transparency and accountability focusing on independent central banks. From a public policy perspective, the case of central banks is interesting for several reasons. First of all, the decisions of these organisations have large societal implications. Even before the financial crisis of 2008-09, variations in policy rates controlled by monetary committees in advanced economies had large impact on aggregate demand and economic activity.[1] Given the importance of these factors for political outcomes, including welfare and elections,

[1] As further discussed below, the distributional effects of central banks' decisions have arguably increased after the crisis and subsequent diffusion of unconventional monetary policy and financial stability mandates (e.g., Bean 2018).

it appears particularly important to examine the drivers of transparency within these organisations. In addition, central banks are often considered among the most independent agencies in modern democracies (e.g., Naurin 2006). As argued below, studying the relationship between delegation, communication and accountability within these institutions should make it possible to derive implications for different policy areas and generalise the findings to different types of organisations.

There already exists a large literature on central bank communication and its impact on economic variables. Especially within economics, a large number of studies have focused on the role of monetary announcements in terms of managing expectations concerning future policy decisions (Blinder, Ehrmann, et al. 2008; Hansen and McMahon 2016b; Hansen, McMahon, and M. Tong 2018). At the same time, the role of transparency in promoting the public accountability of monetary authorities remains little explored. The thesis fills this gap in the literature by studying different aspects of central bank transparency and how it interacts with the institutional environment in which policymakers operate. I focus on three specific research questions, namely, (i) whether monetary authorities' transparency responds to drivers of political scrutiny; (ii) what factors driven dynamics of parliamentary oversight of economic policymakers; and (iii) how transparency interacts with delegation in promoting the credibility and effectiveness (in controlling inflation) of central banks' decisions. The thesis is composed by three research papers, corresponding to chapters 2, 3, and 4, that address these questions separately.

In Chapter 2, I study the relationship between the legislative oversight of the Federal Reserve (the Fed) and the transparency of the Federal Open Market Committee (FOMC). I develop a theory showing how, under reasonable assumptions, the committee's disclosures should increase in response to higher political attention. I test this prediction using computational linguistic methods to extract the amount of information released in the minutes of FOMC meetings, together with the exogenous timing of committee hearings in US Congress and daily data of media coverage of macroeconomic policy to identify effects. I find strong evidence that legislative scrutiny affects the amount of information that the FOMC releases to the public, even after controlling for competing mechanisms.

Building on these results, in Chapter 3 (co-authored with Cheryl Schonhardt-Bailey and James Sanders) I study patters of legislative oversight of central banks' decisions and economic policy in the UK parliament. The paper uses multiple textual analysis

methods to analyse variations in deliberative style across economic policy type (fiscal policy, monetary policy and financial stability) and parliamentary chambers (Commons and Lords). The analysis shows consistent differences in deliberative styles between types of hearings (fiscal, monetary, financial stability) and between chambers (Commons, Lords).

Finally, in Chapter 4 I investigate how communication interacts with institutional independence in promoting monetary authorities' credibility. I build a theoretical framework to argue that central bank independence and communication should be understood as complementary policy instruments. Panel data evidence for 95 countries in the period from 1998 to 2010 strongly supports this view. First of all, I find that inflation is significantly lower in response to an increase in central bank transparency. In addition, I uncover a negative interaction effect between transparency and legal independence in driving price dynamics, suggesting that the two policies interact.

While the three studies focus on different aspects of central bank communication and accountability, they share several common features. One is the empirical challenge of measuring communication in a way that allows hypothesis testing. In the first two papers, I address this problem using approaches from automated content analysis. Previous contributions have noted that a potential limitation of these methods is the difficulty in validating empirical results (Grimmer and Stewart 2013). I address this concern by drawing on multiple approaches to validate results. This has two main advantages. First of all, it constitutes a useful sensitivity check: if different approaches yield similar output, we can be reassured that results are be driven by the structure of the data rather than by the specific method used to process it. Secondly, multiple methods may provide additional insights concerning the issues analysed. As discussed below, this is especially true in the case of multidimensional phenomena, for example public deliberation, which are difficult to measure empirically.

An additional common feature of the three main chapters relates to the contributions they make to the existing literature. As explained shortly, the dissertation makes several contributions to the study of policy delegation, monetary communication, and central bank accountability. First of all, it shows that transparency can emerge endogenously from the policy process; this differs from most accounts of transparency and accountability considered in existing studies (e.g., Stasavage 2004; Meade and Stasavage 2008). Secondly, the thesis examines dynamics of ex-post accountability, including communication and oversight, which have arguably been overlooked by the existing lit-

erature on delegation thus far.[2] In this respect, the dissertation contributes to the study of bureaucratic politics and delegation more generally.

The remaining part of this introductory chapter proceeds as follows. In Section 1.1, I provide a detailed summary of the three papers corresponding to chapters 2, 3 and 4 of the thesis. In Section, 1.2, I provide a general overview of the methodology used in the dissertation. In Section 1.3, I discuss the main contributions of the thesis, while in Section 1.4 I outline its structure.

1.1 Thesis overview

Legislative Oversight and Transparency within Public Organisations: The case of the FOMC

Chapter 2 examines how drivers of political scrutiny in US Congress affect the disclosures of the Federal Open Market Committee (FOMC) of the Federal Reserve (the Fed). In the first part of the study, I develop a theory showing how, under reasonable assumptions, a monetary committee should prefer to communicate to political principals to signal competence rather than remaining silent. The theoretical framework advanced in the paper differs from existing contributions in two ways. First of all, it assumes that monetary committees must exert some efforts to communicate the content of their decisions to the public; this assumption captures potential costs in information transmission, including additional time devoted to the preparation of public statements. Moreover, the model assumes that policymakers have some discretion over the amount of information they provide to the public. This premise captures the fact that, irrespective of legal requirements, communication channels are often controlled by public organisations themselves (McCubbins, Noll, and Weingast 1987). I show that, even under these assumptions, transparency plays an important role in guaranteeing the public accountability of executive agencies. In this case, we should also expect an organisation such as the FOMC to respond to an increase in public scrutiny by releasing additional information concerning its decisions.

The subsequent empirical study tests this prediction by focusing on a specific form of transparency, namely the amount of information released in the FOMC meetings min-

[2]For a discussion of this point, see below and Schonhardt-Bailey (2013; 2015).

utes. More precisely, I measure the disclosures of the committee as the level of semantic similarity between the minutes of a policy meeting and the verbatim transcripts of the same meeting (which the committee has released with a five-year lag since 1993). As a proxy for political attention, I use variations in newspaper coverage of macroeconomic news around FOMC meetings; this is consistent with dynamics of legislative oversight of the Fed in US Congress. Because the salience of economic news is endogenous to the broader financial conditions, I interact this variable with the length of time between a FOMC policy meeting and the occurrence of hearings of the Fed in US Congress under the Full Employment and Balanced Growth Act. The date of these testimonies is independent from the broader economic and financial environment in the decisions of the FOMC take place. I analyse whether the effect of newspaper coverage on the committee's disclosures varies as a function of the length of time between a policy meeting and a testimony. This approach provides a way to distinguish the impact of legislative oversight on the transparency of the FOMC.

The empirical results indicate a significant effect of political scrutiny on the amount of information released by the committee. First of all, I find a positive and robust correlation between the intensity of newspaper coverage of macroeconomic policy in the US and the information included in the minutes of the FOMC. In addition, this effect becomes stronger close to a hearing, which indicates that the committee's communication responds specifically to variations in political attention. These results are robust to different measures of transparency and various robustness checks. In particular, I account for the possibility that an increase in public visibility in moments of greater oversight might stifle internal debate (Hansen, McMahon, and Prat 2018). I find little evidence of this effect. This suggests that –at least in the case of the FOMC– legislative oversight can promote the transparency of independent monetary authorities without necessarily affecting their ability to conduct policy.

Themes and Topics in Parliamentary Oversight Hearings: A New Direction in Textual Data Analysis

The study of the relationship between communication and political accountability is also central to Chapter 3 (co-authored with James Sanders and Cheryl Schonhardt-Bailey). This chapters investigates the form and quality of deliberation in UK parliamentary select committee hearings on economic policy oversight, asking to what extent elected

politicians effectively hold into account officials.

The study analyses the transcripts of parliamentary hearings during the 2010-15 Conservative-Liberal Democratic Government in three different policy areas (monetary, fiscal, and financial policy) and across two different committees, the Treasury Select Committee (TSC) in the House of Commons and the Lords Economic Affairs Committee (EAC). While the TSC has statutory authority to scrutinise both the Bank of England and the Treasury, the EAC also holds hearings with these two actors. The study compares outcomes of deliberative settings across (i) an elected body (the TSC) questioning both unelected officials from the Bank of England (BoE) and elected ministers from the Treasury; and (2) an unelected body (the EAC), which is also questioning both unelected and elected policymakers. A key objective of the study is to analyse whether hearings are conducted in a way that favours reciprocal debates and exchange of ideas instead of overt partisanship. The paper applies multiple methods from computational linguistics (especially topic models and thematic analysis) to measure the substantial content of deliberation and address this question.

Results discussed in the paper suggest that parliamentarians conduct oversight more forcefully when they are challenging fellow politicians as opposed to central bank officials. More precisely, politicians appear to be willing to engage with the arguments presented by BoE's witnesses, while hearings on fiscal policy appear to be more adversarial in style. In addition, the results highlight considerable differences in the style of deliberation between chambers: EAC members seem more willing to engage with technical aspects of policy decisions than politicians serving in the TSC. Finally, the analysis highlights a cross-party consensus in challenging BoE officials on issues related to central bank governance, including transparency. This finding reinforces the idea, central to the dissertation, that transparency is important for the political accountability of monetary authorities.

Central Bank Transparency, Independence, and Credibility

In Chapter 4, I extend the considerations presented in the first two papers to some of the potential economic consequences of central bank communication. I study how communication interacts with institutional independence in promoting monetary authorities' credibility. Differently from most existing contributions on the topic, which focus on central bank independence (CBI) or transparency separately, I examine the complemen-

tarities between these two instruments.

In the first part of the paper, I build on a Barro-Gordon framework to study the interactions between transparency and CBI in driving inflation within countries (Barro and Gordon 1983b). My analysis follows closely existing models of monetary transparency, particularly Faust and Svensson (2001), Geraats (2007) and Frankel and Kartik (2015). The main argument is that, when monetary delegation does not provide perfect information concerning central banks' actual (de facto) level of autonomy, communication plays an important role in promoting policymakers' anti-inflationary reputation. Greater transparency reduces uncertainty about the objectives of policy decisions; this helps central banks to commit to predetermined level of inflation. Building on this reasoning, I anticipate a decrease in inflation following an increase in transparency. In addition, I argue that communication policy and CBI constitute complementary policy instruments. In particular, I expect the impact of an increase in transparency to be stronger when central banks' legal independence is high.

In the second part of the paper, I test these predictions by analysing trends in inflation for 95 countries from 1998 to 2010. To measure the amount of information provided by monetary authorities, I use the index of central bank transparency developed by Dincer and Eichengreen (Dincer and Eichengreen 2007). I use large positive variations in this indicator to identify reforms in transparency. I then analyse how inflation varies before and after the introduction of such reforms. In line with the theoretical predictions, I find that communication strengthens the capacity of monetary authorities to attain stable prices; in my estimates, inflation is about one fifth lower in years in which central banks have adopted greater disclosures as opposed to remaining years. In addition, I find a negative and significant interaction effect between legal CBI and transparency, suggesting that the two policies interact. I conclude with implications for the study of monetary delegation and central bank credibility.

1.2 Methodology

As noted above, the three papers which compose the thesis face a common challenge in terms of "measuring" central bank communication, particularly the amount of information released by monetary authorities and the substantial content of their declarations. One potential solution to this problem is to collect information about central banks' disclosures, for example whether or not certain documents (monetary statements, minutes

of policy meetings) are released to the public. The indicator of central bank transparency developed by Dincer and Eichengreen and discussed in Chapter 4 follows this approach (Dincer and Eichengreen 2007; Eichengreen and Dincer 2014). An advantage of this method is that it allows comparing communication policy across a large number of institutions. However, this approach makes it difficult to analyse the content of communication (what information is actually released), which is arguably important for political accountability.

In chapters 2 and 3, I use methods from automated content analysis to extract the information contained in monetary statements and transcripts of parliamentary hearings. A common feature of these approaches is that they allow deriving quantitative measures from written language, in a way that can be used for statistical analysis and hypothesis testing (Grimmer and Stewart 2013; Benoit 2019). This advantage, however, comes at the expense of a series of assumptions concerning the structure of text, which it is useful to briefly consider here. First of all, many (though not all) of the methods adopted below discard the order in which words appear in the text. This feature of the analysis, together with various editing steps applied to the data (described below), clearly limits the possibility of fully analysing the meaning of the documents. Discarding word order makes it difficult to understand how certain policy issues are treated in the documents; this limitation is particularly serious for the analysis of policy deliberation, where the sentiment or nuances expressed by the speaker can make considerable difference to the meaning of specific documents (e.g., Schonhardt-Bailey 2015).

While this limitation is certainly important, it can be argued that automated content analysis methods still provide useful insights with respect to dynamics of central bank communication and accountability. An example is presented in Chapter 2. In that case, I use the cosine similarity algorithm discussed by Acosta to extract the amount of information about policy decisions released by the FOMC in the policy minutes (Acosta 2015, see also Manning, Raghavan, Schütze, et al. 2008 and Bholat et al. 2015). As further detailed in the paper, this method uses word frequencies to assess to what extent the minutes of policy meetings are consistent with the transcripts of the same meetings. As made clear in the chapter, the resulting measure ignores the order of words in the text. Nevertheless, it still provides an intuitive and consistent indicator of the amount of information disclosed by the FOMC over time. In the same paper, I also show that results are consistent with those obtained with different measures, easing concerns that the findings are driven by the assumptions underlying a specific indicator.

This example illustrates a broader point concerning the methodological strategy adopted in the dissertation, namely the use of multiple approaches to validate empirical results. This general approach is discussed in some detail in Chapter 3. In the context of that chapter, it is argued that combining multiple computational linguistic methods to the analysis of political phenomena provides two main advantages. First, it increases the robustness of the results, by showing that relevant outputs are not exclusively the result of a specific method or algorithm. Second, it allows to leverage on the respective strengths of different techniques to study the output of interest. In the chapter, for example, multiple approaches are used to analyse ways in which parliamentarians conduct oversight. The study shows that different approaches can be jointly used to capture concepts such as "reciprocity" that, while crucial to understanding public debates (Barabas 2004; Mucciaroni and Quirk 2006), are inherently difficult to study quantitatively. In so doing, the thesis contributes to the growing literature which uses textual analysis to the study of public policy issues.

1.3 Contributions

Beyond the methodology, the dissertation contributes to the existing literature on bureaucratic delegation and central bank communication. I now provide an overview of these contributions, which are considered in greater detail in the next three chapters.

Transparency and accountability within public institutions

The thesis contributes primarily to the study of transparency and accountability within public organisations. In particular, I provide several reasons why transparency can emerge endogenously from political processes of delegation and oversight. This perspective is distinct from most existing accounts of transparency in public policy settings, which generally conceive disclosures as something imposed externally on organisations (e.g., McCubbins, Noll, and Weingast 1987; Hood and Heald 2006). In the thesis, I discuss several reasons why agencies might want to autonomously increase the transparency of their decisions. In Chapter 2, for example, this effect derives from political incentives, while in Chapter 4 communication is adopted to limit public's uncertainty concerning policymakers' preferences. In both cases, the theoretical arguments an advanced in the dissertation suggest that, irrespective of formal requirements, organisa-

tions might want to autonomously provide information concerning their actions.

By focusing on how monetary authorities can use transparency to promote their accountability, the dissertation has also implication for the study of potential trade-offs between transparency and efficiency in public policy settings (Hagemann and Franchino 2016; Hansen, McMahon, and Prat 2018). In particular, some existing studies suggest that excessive disclosure may be counterproductive from a policy perspective, for example by inducing policymakers to withdraw information to avoid the risk of being perceived incompetent (Stasavage 2004; Meade and Stasavage 2008). The results discussed in the thesis indicate that, while communication can impose costs on organisations, it also has considerable benefits in terms of managing political pressures and promote the accountability of monetary policymakers. The communication behaviour of the FOMC discussed analysed in Chapter 2 appears to be consistent with this view. In this respect, the thesis shifts the focus from the impact of transparency requirements on organisations' decision-making, to the role of communication in promoting the reputation of public agencies (Carpenter and Krause 2012).

These insights have also implications for the study of bureaucratic delegation more broadly. Previous contributions have mostly focused on the incentives for elected governments to delegate policy (Moe 2012), or on the institutional devices used by politicians to constrain organisations' discretion (Gailmard and Patty 2012). However, this literature largely overlooks the ways in which promote their accountability after delegation has taken place (Carpenter and Krause 2012; Schonhardt-Bailey 2015; Lowande 2019). Communication and legislative oversight are both central elements of organisations' ex-post accountability. Monetary policymakers, like other public officials, are being regularly called to provide reasons for their decisions to elected politicians and the broader public. Under these circumstances, it becomes important to ask whether agencies' communication responds to drivers of political scrutiny, and whether political oversight succeeds in providing information concerning organisations' actions. These two questions are central to the thesis.

Finally, as already noted, an advantage of studying highly independent institutions such as central banks is that it should be possible to extend the findings to different contexts. In particular, the impact of legislative oversight on transparency outlined in Chapter 2 should also apply in policy settings where organisations are less autonomous from executive governments and the risk of interference is higher. For example, the arguments outlined in the thesis appear consistent with existing contributions which

examine voluntary disclosures and communication among financial regulators (Gilad, Maor, and P. Bloom 2013) and within local government (Koop 2014). These considerations suggest that the arguments presented in the thesis can be extended to different areas of government; this point is further discussed in Chapter 5.

Central bank communication

While being primarily focused on the public policy dimension of central bank transparency, the dissertation contributes also to the large literature on monetary communication developed within economics. As noted above, there already exists substantial research investigating the effects of monetary announcements on economic variables (e.g., Blinder, Ehrmann, et al. 2008; Hansen and McMahon 2016b; Hansen, McMahon, and M. Tong 2018). Nevertheless, the role of communication in promoting the accountability of monetary committees has received less attention thus far. This lack of understanding is especially puzzling when considering that this function of communication is often mentioned by senior policymakers when supporting greater transparency in central banks' decisions (Bernanke 2004; Yellen 2013).

One of the main contributions of the thesis is to establish a link between mechanisms of political oversight and the communication behaviour of monetary committees, thus providing first empirical evidence of a relationship between central bank transparency and public accountability. A central result discussed in Chapter 2 is that, by providing information about policy decisions to politicians, monetary committees limit the risk of political repercussions; the communication behaviour of the FOMC varies in a way that is consistent with this theory. The evidence discussed in Chapter 3, in turn, suggests that politicians which participate to parliamentary oversight of the BoE are willing to engage with the explanations of the monetary decisions presented by the bank's officials. This reinforces the idea that communication and account-giving activities may bring benefits in terms of managing the broader political environment in which monetary committees operate. In this respect, the thesis contributes also to recent approaches which study central banks' communication with the broader public and the role of announcements in building public trust (Haldane and McMahon 2018).

Together, these arguments have also several policy implications. Especially since the 2008 financial crisis and the adoption of unconventional monetary policies and financial stability tasks by several central banks, monetary policy decisions have attracted

increasing political scrutiny (Kohn 2013; Goodhart and Lastra 2018). Because these additional policy functions potentially have stronger redistributive implications than interest rate decisions (Bean 2015; 2018), they also arguably require additional ways to promote central banks' accountability.[3] The arguments tested in the dissertation suggest that an active communication policy can help monetary policymakers manage such legislative pressures on their decisions. Similarly, the thesis suggests that mechanisms of political oversight are effective in disclosing policy-relevant information to politicians. This is arguably relevant for the design of policy delegation to central banks in various areas, including financial policy (IMF 2013), as further discussed in Chapter 5.

Finally, Chapter 4 advances the large literature on the use of transparency as a way to reinforce the credibility of monetary commitments. Several contributions suggest that an increase in transparency should make it easier for the public to monitor central banks' actions and verify they are consistent with low and stable inflation, with positive effects for credibility (Faust and Svensson 2001; Geraats 2002; Eichengreen and Dincer 2014). The chapter contributes to this literature by providing direct empirical evidence of an impact of transparency on inflation, and how this effect interacts with dynamics of monetary delegation. Not only I find evidence that transparency is more effective when supported by institutional arrangements that strengthen central bank autonomy, but also that the impact of CBI on inflation is often conditional on the adoption of an open communication strategy by monetary authorities. In this respect, the thesis contributes also to the large empirical literature on central bank delegation (Alesina and Summers 1993; Laurens, Arnone, and Segalotto 2016), which has mostly overlooked complementarities with transparency thus far.

1.4 Thesis outline

The thesis is composed by three papers, which correspond to chapters 2, 3 and 4 of the dissertation. Each chapter starts by outlining the research questions; it then provides details of the methodology and presents the key results. Chapters 2 and 4 provide formalisations of the key intuitions as a way to organise the data. In these two chapters, the theoretical discussion focuses on the main results and empirical predictions, while proofs are reported in the appendix. To conclude, Chapter 5 provides a summary of

[3]These considerations are especially important given the recent policy responses to the COVID-19 pandemic (Yashiv 2020), as further discussed in Chapter 5.

the main findings contained in the thesis, outlines suggestions for future research, and describes the key policy implications.

Chapter 2

Legislative oversight and transparency within public organisations: The case of the FOMC

Information transmission between executive agencies and their political supervisors constitutes a key policy issue. Over the past few decades, governments and legislators have delegated a range of policy functions to specialised agencies including in the fields of monetary policy and financial stability (Moe 2012). Such a shift has taken place alongside the diffusion of instruments and procedures which allow legislatures to monitor organisations' actions and curb their discretion in response to perceived lack of competence (e.g., Hood and Heald 2006). Effective oversight, however, requires information concerning agencies' decisions and their intended effects: in the absence of such information, legislators will find it difficult to distinguish the outcome of bureaucracies' decisions, making the task of evaluating their actions almost impossible (Gailmard and Patty 2012).

Communication, and transparency more broadly, has long been recognised as a potential solution to this problem. Timely release of information about organisations' decisions helps politicians enhance their oversight capacity, allowing elected representatives to keep bureaucracies accountable while limiting monitoring costs (e.g., McCubbins and Schwartz 1984). Yet the mechanisms through which agencies offer accounts of their decisions, and how this responds to structures of legislative oversight that shape organisations' accountability, has been little explored in the literature. To study executive

agencies' disclosures, scholars have mostly focused on legal disclosure requirements (e.g., McCubbins, Noll, and Weingast 1987) –thus seeing transparency exclusively as something externally imposed by legislators (Stasavage 2004; Meade and Stasavage 2008). This is puzzling given that, in practice, bureaucratic organisations often retain substantial control over the amount of information they release (Potter 2017). In several domains –including monetary policy and financial stability- agencies' accounts of their decisions often constitute the bulk of the information used by politicians to evaluate policy outcomes (Woolley and Gardner 2009; Gilad, Maor, and P. Bloom 2013). Asking whether the legislative oversight affects the transparency of delegated agencies, and how organisations' disclosures respond to drivers of political scrutiny, is thus important for analysing political accountability more broadly (Florini 2007; Hood 2010b).

In this paper, I study how legislative oversight affects the communication behaviour of the Federal Reserve's (Fed) Federal Open Market Committee (FOMC). I develop a theory showing how, even in the absence of formal disclosure requirements, an organisation may prefer to communicate its decisions to signal its competence rather than remaining silent. In the model, a public organisation takes a policy decision and exerts effort to explain it to a politician, who in turn must decide whether to sanction the agency on the basis of its perceived competence. I suggest that, because transparency helps organisations to manage legislative pressures, we should also expect disclosures to increase with the level of political scrutiny of their decisions.

The empirical study tests this argument by focusing on a specific form of FOMC disclosures, namely the amount of information released in the meetings minutes. I use methods from computational linguistics to extract the level of information contained in the documents, and I analyse how this information changes according to the level of political scrutiny of committee's decisions. FOMC disclosures are measured as the level of *semantic similarity* between the minutes of a policy meeting and the verbatim transcripts of the same meeting (Acosta 2015), which the committee has released with a five-year lag since 1993. This approach yields a quantitative proxy of transparency which can be used to for statistical analysis. To distinguish the effect of oversight, in turn, I combine newspaper coverage of macroeconomic policy around FOMC meetings with the exogenous timing of semiannual testimonies in US Congress. As further explained below, the schedule of these hearings is unrelated to the broader economic and institutional environment in which the committee operates. This allows to analyse the effect of newspaper coverage on the committee's disclosures as a function of the

length of time between a policy meeting and a testimony, thus identifying the effects of legislative attention on the FOMC's communication behaviour.

The empirical results indicate a significant effect of political monitoring on the committee's disclosures. There is a positive and robust correlation between the level of newspaper coverage of macroeconomic policy ahead of FOMC meetings and the amount of information included in the committee's minutes; in addition, this effect is stronger close to a testimony, suggesting that the FOMC responds specifically to variations in political oversight in US Congress. The results are robust to the use of alternative measures of legislative scrutiny, different proxies for policymakers' disclosures, and additional robustness checks. As a further step in the analysis, I carry out additional tests on the verbatim transcripts of FOMC policy meetings, which the committee releases after five years from each meeting. I find little change in the dynamics of deliberations reported in the transcripts in response to greater oversight. This result indicates that, at least in the case of the FOMC, political oversight is useful to promote the transparency of executive agencies without adversely affect their ability to conduct policy.

The paper contributes primarily to the existing literature on agency behaviour and legislative control of the bureaucracy (e.g., Huber and McCarty 2004; Lewis 2007; Selin 2015), particularly with respect to forms of ex-post accountability and day-to-day interactions between organisations and elected politicians (Potter 2017; Lowande 2019). In addition, the analysis contributes to the study of central bank transparency, by highlighting the role of communication in promoting the political accountability of monetary committees. This approach differs from current studies on central bank communication, which generally focus on the role of announcements on policy transmission (e.g., Kohn and Sack 2003; Swanson 2004; Hansen and McMahon 2016b). In the conclusions, I highlight the implications of the study for the institutional designs of monetary institutions, particularly with respect to the diffusion of financial stability tasks among central banks and the potential need to communicate decisions across different policy areas (e.g., IMF 2013; Bean 2015; 2018).

The paper proceeds as follows. Section 2.1 reviews existing approaches to the study of agencies' disclosures. Section 2.2 outlines the theoretical framework used to derive implications for the empirical analysis. Section 2.3 provides institutional backgrounds on FOMC's communication and oversight. Section 2.4 outlines the empirical strategy and computational linguistic approaches used in the study. Section 2.5 describes the data. Sections 2.6, 2.7, 2.8, and 2.9 outline the main results and discuss the robustness

checks. Section 2.10 concludes.

2.1 Political oversight and agencies' communication

The relationship between legislative oversight and bureaucracies' communication has been object of considerable debate in public policy (e.g., Hood and Heald 2006; Florini 2007). A common view is that disclosure requirements imposed by legislators on bureaucracies help politicians ease information asymmetries, enabling elected officials to better understand the consequences of agencies' actions (e.g., McCubbins, Noll, and Weingast 1987; 1989). By requesting agencies to disclose policy-relevant information, legislators can ease opportunity costs involved in continued monitoring; this allows politicians to focus their attention politically salient decisions, limiting oversight costs (McCubbins and Schwartz 1984). Transparency is thus conceived as something externally imposed on organisations, allowing politicians to undertake administrative procedures against agencies in case of perceived lack of competence, or when their policies deviate from those preferred by legislators (Gailmard and Patty 2012).

A narrow focus on disclosure requirements, however, poses several conceptual challenges. First of all, irrespective of legal provisions, agencies retain considerable control over the amount of information they release to the the public (Hood and Heald 2006). In the case of the FOMC, for example, full transcripts of the policy discussions are only available with a five-year lag from each policy meeting,[1] making the use of these documents to assess the committee's decisions in real time difficult; more commonly, political overseers of the Fed rely on the information autonomously released by the committee (monetary statements and meetings minutes) to assess the impact of policymakers' decisions (Woolley and Gardner 2009; Schonhardt-Bailey 2013). Similarly, the Monetary Policy Committee of the Bank England has only recently allowed the release of meeting transcripts,[2] while the Governing Council of the European Central Bank does not release such documents. In these cases, political supervision relies on the information about policy decisions that the committee is willing to release. Such examples illustrate a broader feature of oversight. In practice, politicians often focus on agencies'

[1] A more detailed description of the FOMC's communication policy is reported in Section 2.3.

[2] See `https://www.telegraph.co.uk/finance/bank-of-england/11287217/Bank-of-England-unveils-major-shake-up.html`.

disclosures in their oversight tasks;[3] in this case, however, "[...] the agency both keeps the books and performs the audit" (McCubbins, Noll, and Weingast 1987 1987: 251), raising doubts concerning the effectiveness of legal requirements in revealing policy-relevant information to legislators. An implication is that, to study communication in legislative oversight, it appears necessary to evaluate the incentives for transparency of delegated agencies, and how they interact with the drivers of political scrutiny of their decisions.

A further issue is that, by focusing on monitoring costs, existing accounts of legislative oversight largely overlook communication costs for organisations. In general, information transmission requires human and financial resources, thus imposing costs agencies (e.g, Hood 2010b; Potter 2017). Moreover, policymakers face considerable opportunity costs when preparing their announcements, given that discussing their content requires time that could be allocated to other policy tasks: members of the FOMC, for example, spend a significant amount of time during policy meetings discussing the exact language to be adopted in their statements (e.g., Dudley 2016). Communication can also be counterproductive for organisations, by making it easier for politicians and other external observers to distinguish an incorrect decision (Stasavage 2004; Prat 2005; Fox and Van Weelden 2012).[4] In the case of monetary committees, for instance, excessive transparency might make it difficult for policymakers to adjust policy due to unforeseen circumstances, as this would signal a policy reversal and potentially raise uncertainty concerning policymakers' intentions (Blinder, Ehrmann, et al. 2008; Coibion and Gorodnichenko 2012).[5] Taken together, these considerations suggest it is unlikely that agencies' communication mechanically reflects legal requirements; on the contrary, we should expect policymakers to balance the benefits of greater transparency with the potential costs involved in communication. As a result, several questions emerge concerning when agencies communicate their decisions to politicians; whether their disclosures responds to drivers of political monitoring; and ultimately whether legislative oversight promote greater disclosure and accountability among public organisations (e.g., Hood

[3]For a broader discussion of this point and policy examples, see e.g., A. S. Roberts (2005); Hood and Heald (2006).

[4]This finding is common in formal political economy literatures based on career concerns; Hansen, McMahon, and Prat (2018) review this literature in detail.

[5]William Dudley, former President of the New York Fed, commented: "[w]e tend to make relatively few changes to the statement language [...] For monetary policy to be effective, it is important to have clarity about what the FOMC can be clear and consistent about?" (Dudley 2016).

and Heald 2006).

To address these issues, in the next section I develop a new theory of political oversight and bureaucratic transparency. I argue that although communication entails costs for public organisations, it also helps bureaucracies to enhance their reputation and manage political pressures. If this is true, we should expect bureaucracies to respond to an increase in political scrutiny by increasing their disclosures. This result is broadly consistent with existing approaches to oversight mentioned above; yet the theory does not require the legislature to impose disclosure requirements on the bureaucracy, nor politicians to be able to independently assess the amount of information released by the agency. Because communication can be used by a bureaucracy to make its policy decisions clear to supervisors, we should expect agencies to engage in communication as a way to signal their competence. Thus, there are potential gains –along with costs– involved in transparency. To formalise this idea, below I build on Dewatripont and Tirole's (2005) model of costly communication; as made clear in the the next section, this framework allows to evaluate complementarities between agencies' communication and the level of political monitoring. I study a setting in which an agency is in charge of policy decisions a politicians must assess the organisation's competence,[6] which arguably describes reasonably well dynamics of supervision within the FOMC studied later the paper. The aim of the formalisation is to identify conditions for which legislative oversight might affect communication, so to be able to derive testable implications for the subsequent empirical analysis. For this reason, below I describe the simplest version of the model; extensions to the basic framework are briefly mentioned alongside the main explanation.

2.2 Model

I study the interactions between an executive agency $j \in \{h, l\}$ and a representative legislator (a politician P, she) who must decide whether or not to sanction the agency on the basis of its perceived competence. The agency takes an action $a \in \{0, 1\}$ ac-

[6]Such setting differs from most existing models of bureaucratic behaviour, where agencies are assumed to make a recommendations to politicians that are then responsible for policy implementation (Gailmard and Patty 2012). In many contexts, including monetary committees, bureaucracies are directly delegated policy tasks; nevertheless, politicians retain discretion to undertake administrative procedures and other sanctions to keep organisations accountable (McCubbins, Noll, and Weingast 1987; Carpenter and Krause 2014).

cording to private information about an underlying policy variable $\omega \in \{0, 1\}$, with each state equally probable, and sets a level of communication effort $y_j \in [0, 1]$ –not observed by the legislator- used to communicate that decision. The binary choice faced by the bureaucracy describes reasonably well the decision-making internal to monetary committees, which normally have to decide whether to tighten or loosen policy rates against the alternative of leaving them unchanged (Meade and Stasavage 2008). Following the discussion above, I assume the bureaucracy's communication efforts to be costly; I model communication costs as continuous in $(0, 1)$ and distributed according to the twice differentiable function $c(y)$, where $c'(y) > 0$, $c''(y) > 0$, $c(0) = 0$ and $c(1) \geq 1$.

The politician observes the outcome of j's policy with some probability and decides whether or not to increase political pressures on the agency, choosing action τ, or to uphold its autonomy (in this case, she chooses action n). In this setting, τ corresponds to action which politicians may use to raise pressures on public organisations (McCubbins, Noll, and Weingast 1989). It includes legislative sanctions commonly studied in the literature on oversight such as hearing requests, investigations, and punitive legislation (e.g., Carpenter and Krause 2014; Lowande 2019), as well as more nuanced forms of political control such open criticism during oversight hearings (McCubbins, Noll, and Weingast 1987; McGrath 2013). There is abundant evidence that even largely independent agencies such as the FOMC care about the possibility of such outcomes, which can both hurt policymakers' reputation and affect their ability to conduct policy (Schonhardt-Bailey 2013; Broz 2015; Binder and Spindel 2016);[7] in line with existing contributions, I assume the bureaucracy to have interest in minimising political pressure whenever possible.[8]

Before setting the policy, the agency receives a binary signal s_j about the state variable ω. Following Prat (2005), I denote as $q_{j,\omega} = Pr(s = 1|j, \omega)$ the probability that the signal is correct when the state is 1. The accuracy of the signal depends on the bureaucracy's competence.[9] If the agency has a high competence (it is of type h), the signal is perfectly correlated with the state. If the agency has a low competence (it is of type l), the signal is correct with probability, $q_{l,\omega} \in (0.5, 1)$. In line with existing literature, I assume that the best policy is the policy matching the state of the world; let $u = 1$ denote

[7]For additional examples, see Carpenter and Krause (2012) and Moe (2012).

[8]This point is further evaluated in the case of the FOMC in Section 2.3.

[9]This is a common assumption in existing models. For a similar setting, see for example Meade and Stasavage 2008.

policy outcome when $a = \omega$, and $u = 0$ be the outcome when $a \neq \omega$.[10] The politician does not directly observe s_j, but she can form ex-post beliefs concerning the agency's type based on the policy realisation; more precisely, I denote as $\pi(h|u)$ the posterior probability that the agency is high competence h after observing the policy's outcome. In the framework, competence is unknown to all players before any action is taken; it is also common knowledge that the ex-ante probability that the agency's competence is high is equal to λ.

The probability that the politician learns the consequences of the bureaucracy's action is given by the combined effects of the agency's communication efforts y and P's level of monitoring $x \in (0, 1)$. From the point of view of the agency, the parameter x gives the *expected* level of supervision which, in this setting, I assume to be predetermined and observable by the bureaucracy. This variables captures anything that may signal to the bureaucracy the actual level of attention of the legislator. Following existing approaches to legislative oversight, it can be specifically understood as the public salience of the bureaucracy's actions (McCubbins and Schwartz 1984); a high level of salience (as measured, for example, by newspaper coverage, see Carpenter (2002); Koop (2014)) raises the politician's attention to the agency's messages, thus increasing the probability that she will be able to distinguish the effects of the organisation's decision and its policy consequences. In Section 2.3, I provide anecdotal evidence supporting this interpretation in the case of the FOMC.

To study the role of communication in politician's learning, I consider simplest case in which with probability $y_j x$ the politician understands both a and u, while with probability $1 - y_j x$, P does not learn neither the decision taken nor its consequences.[11] Thus, the politician's ability to learn the policy outcome depends entirely on her understanding of the policy decision a. This assumption describes settings, including monetary policy, where lag in the effects of policy decisions and other uncertainties imply a strong complementarity between understanding policy actions and their consequences (e.g, Greenspan 2004; Faust and Leeper 2015).[12] It also captures the importance of transparency for politicians' ability to sanction agencies for their decision, given that

[10] The notation is taken from Prat (2005).

[11] This communication technology is taken from Dewatripont and Tirole (2005). In the appendix, I consider a more general case in which the politician can learn the consequence of the agency's decision with some probability, even without observing the action taken by the organisation.

[12] This is likely to apply to public policy setting more broadly (McCubbins, Noll, and Weingast 1987: 250).

effective monitoring arguably requires politicians be able to condition the sanction on the match between agent's choices and the information it had at the time when it made the choice (Gailmard and Patty 2012: 369). In the the Appendix, I show that the findings below apply to a more general setting in which the legislator is allowed to understand the effects of the policy decision with some positive probability p.

P's payoffs depend on the policy outcomes as well as on the effects of the sanction which, in line with the oversight literature (e.g., McCubbins, Noll, and Weingast 1987; Hood and Heald 2006), depends on j's competence. Specifically, the legislator gets a positive payoff $r > 0$ if she undertakes an administrative procedure and the agency is of type l, while she loses r following a sanction if the agency is of type h. I set the payoff from not undertaking an administrative procedure (action n) to be 0.

$$U_P(u, \tau, j) = \begin{cases} u - r, & \text{if P chooses } \tau \text{ and } j = h \\ u + r, & \text{if P chooses } \tau \text{ and } j = l \\ u & \text{if legislator chooses } n. \end{cases} \tag{2.1}$$

The bureaucracy is similarly interested in a good policy outcome,[13] but it also cares about avoiding a sanction. I define $k > 0$ the loss arising from an administrative procedure for the agency, while I assume its payoff to be 0 if the politician decides not to proceed with the sanction. Thus the payoffs for the agency depend on the legislator's action as well as on the efforts exerted to communicate the policy to the supervisor.

$$U_j(y_j, \tau, n) = \begin{cases} u - k - c(y_j) & \text{if P proceeds with the sanction} \\ u - c(y_j), & \text{otherwise} \end{cases} \tag{2.2}$$

The timing of the game is as follow:

0. Nature selects the type of agency j, the state of the world ω and the level of the legislator's attention x.

1. The agency the observes s, sets the policy a, and decides the level of communication y, unobserved by P.

2. The policy outcome u is realised and, if communication is successful, it is learnt by the politician.

[13] Existing contributions point to the fact that public policy officials normally care about the legitimacy and outcomes of their decisions (March and Olsen 2004; Koop 2014).

3. P decides whether to undertake an administrative procedure τ or not.

The equilibrium concept is Perfect Bayesian Equilibrium in pure strategies, with the caveat that the politician decides to sanction the agency when she is indifferent. Finally, to ensure that communication plays a meaningful role in the oversight process, below I also make the following assumption on P's prior beliefs:

$$\frac{q_l}{1+q_l} < \lambda \leq 0.5 \tag{2.3}$$

As further discussed below, this relationship describes a situation in which politicians actually needs to be persuaded not to proceed against the agency (as in McCubbins, Noll, and Weingast 1989), but in which the organisation can actually affect P's behaviour. If the politician's prior was excessively low, demonstrating to have taken a good decision would not be enough for the agency to avoid a sanction; in this case, transparency would not have any role in oversight given that the bureaucracy, irrespective of its type, always would opt for zero communication efforts. Similarly, if P had a high (above a half) prior belief concerning the bureaucracy's ability, the agency would avoid a sanction irrespective of communication, and the signalling game would not be meaningful.[14] Hence Assumption (2.3) describes context in which public organisations must actually undertake efforts to convince legislative supervisors of their competence, and in which their policies allow legislators to better assess the competence of the bureaucracy; both features are consistent with existing accounts of legislative oversight (e.g., McCubbins, Noll, and Weingast 1987; Lowande 2019). In Section 2.3, I go back analysing the validity of this premise in the case of the FOMC.

2.2.1 Equilibrium dynamics and predictions

As discussed above, two key questions for the analysis of bureaucratic transparency are (i) under what conditions the agency has interests in exerting efforts to communicate

[14]This part of the assumption can be relaxed. An analogous setting, for example, would entail the bureaucracy getting a positive payoff $B > 0$ whenever the principal thinks the agency's competence is high, and 0 otherwise. Such alternative payoff structure would be consistent with the large literature in public administration which highlights the importance of agencies' reputation for their autonomy (reviewed by Carpenter and Krause 2012 and Busuioc and Lodge 2016), and would not require assuming the politician to be biased against the agency. I focus here on the loss arising from sanctions, as highlighted in the payoff function (2.2), to make the link with the oversight literature clearer. For an overview of the relationship between bureaucracies' reputation and their autonomy, see Carpenter 2014.

its decisions and (ii) how do levels of expected oversight x affect its communication choices. I now analyse these points in turn. To derive testable hypotheses, I focus on a pooling strategy in which both types of agency set $a_j = s_j$ and opt for a positive effort $y_j > 0$. This allows to derive predictions concerning the role of communication for accountability without making considerations regarding the competence of the bureaucracy, which might be difficult to measure empirically (Carpenter and Krause 2014).

To solve the game, I proceed by backward induction. First of all, if both types of agency choose to exert efforts to explain the policy decision, the politician uses the outcome of the policy decision u to infer the bureaucracy's competence whenever communication is successful. Bayes rule implies that P is certain to face a low-competence agency after observing a policy failure ($u = 0$), and that –using Assumption (2.3)- the posterior belief concerning the bureaucracy's competence is higher than one half after observing a good outcome ($u = 1$).[15] In this respect, observing policy outcomes helps the politician to better understand the competence of the bureaucracy (McCubbins, Noll, and Weingast 1987). Secondly, in the final stage the politician rationally chooses to undertake the sanction whenever the probability of facing a low-competence agency exceeds the probability of facing a high-competence one. This implies that P chooses to uphold the bureaucracy's autonomy after learning that the agency's decision was correct (in this case, she chooses action n), and that she opts to increase political pressure on the bureaucracy otherwise (she chooses action τ).[16] Hence, in this frame-

[15]This follows directly from the the structure of the model and the assumptions. By observing both the outcome of the policy decision and the decision itself, the politician can recover the initial state of the world, thus inferring whether the agency's decision was correct or not (Prat 2005). As the high-competence agency has a perfectly accurate signal, observing a policy failure implies P is facing a low-competence bureaucracy. Considering the case in which the state is $\omega = 1$, the posterior is given by $\pi(h|u = 0) = 0$. The politician's posterior after observing a positive outcome is given instead by

$$\pi(h|u = 1) = \frac{0.5 \cdot \lambda \cdot 1}{0.5 \cdot \lambda \cdot 1 + 0.5 \cdot (1 - \lambda) \cdot q_l} > 0.5$$

by Assumption 2.3. The result is analogous in the case in which $\omega = 0$.

[16]Formally, the politician chooses action τ whenever $EU_P(\tau) \geq EU_P(n)$. This is equivalent to choose τ whenever the probability of facing a high-competence type is lower than one half:

$$\begin{gathered} EU_P(\tau) \geq EU_P(n) \\ \Rightarrow Pr(j = h|u)(u - r) + (1 - Pr(j = h|u))(u + r) \geq u \\ Pr(j = h|u) < 0.5 \end{gathered} \tag{2.4}$$

Given assumptions on the prior, this is true if communication does not succeed (as $\lambda < 0.5$) and after observing a policy failure, given that in this case the posterior is equal to 0 (see previous footnote).

work the capacity of the bureaucracy of avoiding legislative pressures depends on the legislator being persuaded of the agency's overall ability; this is consistent with existing accounts of legislative oversight in US Congress (Schonhardt-Bailey 2013; Binder and Spindel 2016).

Consider now the choice of the agency. First of all, given that the signal s_j conveys information about the state, it is reasonable to expect the bureaucracy to choose set the policy equal to the signal: the reason is that deviating from this decision would imply choosing an incorrect policy more often, leading to lower payoffs on average. In addition, the posited strategy requires the agency to exert a positive communication effort $y_j > 0$. Given P's behaviour, if communication succeeds and the decision is correct, the bureaucracy avoids the sanction. If instead communication fails or if the decision is proven to be wrong, the agency faces a sanction; nonetheless, the bureaucracy faces an administrative procedure also if it decides not to exert communication effort, deviating to $y_j = 0$. This implies that the agency is strictly better-off exerting positive communication efforts, suggesting that the pooling strategy can be supported in equilibrium. In particular, in the Appendix I show that the following Proposition holds.

Proposition 1. *There exists a pooling equilibrium in which both h and l types exert positive communication effort $y > 0$. In this equilibrium, the following conditions hold:*

- *The politician sanctions the agency after observing a wrong decision, and whenever communication fails;*
- *The agency sets $a_j = s_j$;*
- *The communication effort of the agency satisfies*

$$c'(y_j^*) = kq_j x. \tag{2.5}$$

Proposition 1 captures the main accountability mechanism involved in bureaucratic communication. As in McCubbins, Noll, and Weingast (1987, 1989) timely communication of policy decisions helps politicians keep executive agencies accountable for their actions. However, in this case communication depends exclusively on the incentives of the agency: even in the absence of formal legislation, and even if it controls the amount of information it discloses, the bureaucracy has interest in making its decision clear as a way to manage legislative pressures. Note this result does not require

the legislator to be able to assess how much information is actually released by the bureaucracy, which in practice might be challenging to do (Hood and Heald 2006): on the contrary, transparency emerges endogenously as a way in which public organisations reveal policy-relevant information to their political supervisors.[17]

In addition, the framework makes it is possible to study how communication responds to a change in political monitoring. In particular, using Equation (2.5) it possible to show that the agency's transparency should always in increase in response to an increase in the level of expected oversight.[18]

Proposition 2. *The agency's equilibrium effort y_j^* is always increasing in the level of legislative oversight x,*

$$\frac{\partial y_j^*(x)}{\partial x} > 0.$$

As the level of legislative monitoring increases, there are higher chances that the politician will actually be able to learn the consequence's of the agency's decisions. This raises the bureaucracy's expected payoffs from investing in communication and encourages greater disclosure. Thus a testable implication of the model is that, if political accountability matters for public sector agencies, there should be a positive association between drivers of political monitoring and their transparency.[19] In other words, high levels of legislative scrutiny should be associated with additional information released by public agencies.[20] In summary, I anticipate a positive relationship between drivers of legislative oversight and bureaucracies' disclosures.

[17] In this respect, the theory allows explaining why bureaucracies often provide more information than what is legally required (e.g., Busuioc and Lodge 2016).

[18] The proof is reported in the Appendix.

[19] This is not the only prediction of the model. Using Equation (2.5) it is similarly possible to show that communication efforts should increase with the expected loss from political pressure k and, for a low-competence bureaucracy, with the precision of the signal. I leave empirical investigation of these further hypotheses to future research.

[20] This is largely consistent with recent contributions which suggest that agencies tend to communicate more in areas which are politically more salient (Gilad, Maor, and P. Bloom 2013; Koop 2014; Moschella and Pinto 2018). I further discuss this point in the conclusions.

2.3 The case of the FOMC

I now proceed to test my hypotheses using communication data and patterns of legislative oversight of the Federal Reserve's FOMC. The remaining part of this section provides the necessary institutional background to the committee's meetings, communication policy, and legislative oversight. The following two sections describe the data sources, empirical strategy, and textual analysis methods used for the analysis.

2.3.1 FOMC meetings and communication

The Federal Open Market Committee meets eight times a year, at pre-specified dates that do not change much from one year to another, to formulate monetary decisions and determine other Fed policies. At any meeting, the FOMC is composed by twelve members –seven members of the Board of Governors (including the committee chairperson); the president of the New York Fed; and four of the remaining eleven Reserve Bank presidents serving one-year rotating terms–. The main policy variable is the target level of the federal runds rates,[21] as well as potentially a tilt in the future policy stance. This is decided after policy discussions in which all policymakers, including non-voting Presidents, participate.[22] Meetings normally last one day apart from those meetings preceding semiannual testimonies of the FOMC Chair in Congress (described below), which last two days.

FOMC communication policy has evolved substantially since the early 1990s, in response to evolving understanding of the role of transparency in monetary policy (e.g., Blinder, Ehrmann, et al. 2008).[23] Immediate communication of policy decisions started in 1994, when the committee first released a statement announcing the outcome of the policy meeting. The publication of monetary statements remained irregular until 1999,

[21] The rate at which commercial banks borrow and lend reserves overnight. Following the financial crisis, policy decisions have arguably expanded to entail asset purchases and financial stability considerations (Axilrod 2013). While changing target levels of federal funds rates indirectly affects economic activity by influencing longer-term rates on which most investment decisions depend, asset purchases ('quantitative easing') directly seek to influence long-term rates by purchasing large amounts of long-term US Treasury securities (e.g., Labonte 2015). The difference between these policy instruments does not affect the argument, which is exclusively based on how the committee explains its policy decisions. In any case, below I repeat the analysis excluding observations taking place after the crisis.

[22] Fed staff participates to the discussions as well.

[23] The discussion in this section is based on Blinder, Ehrmann, et al. (2008); Wynne (2013) and the Fed's website at `https://www.federalreserve.gov/monetarypolicy.htm`.

when the statements started being released after each meeting. Since then, the content of these announcements has been progressively enriched with additional information concerning the committee's views about the economy; until early 2000s, however, monetary statements were limited to few sentences to inform the public about the policy decisions (Wynne 2013). Prior to this, the most detailed explanation of the rationale underlying the decision-making process was contained in the FOMC minutes (called Minutes of Actions before 1993), which the committee has released after six weeks from each meeting from 1976 to December 2004, and three weeks after each meeting from January 2005.

The minutes are prepared by the FOMC Secretariat based on the transcripts of policy discussions (see below); they are then reviewed and approved by committee members, which often discuss their contents during the meetings.[24] The structure of these documents has remained broadly stable since 1976; they include a description of the domestic open markets and foreign currency operations authorised by the committee; a summary of Fed staff's review of economic developments; a summary of the debate; and the description of the committee's policy decision. On two occasions the format of the minutes has been slightly modified to better reflect the policy views of committee members: this happened in January 1993, when the committee agreed to change the format to make them more representative of the internal deliberations (FOMC Transcripts 23/03/1993: 1) and in 2007, when the committee started appending to the minutes individual members' forecasts twice a year. In addition, in December 2004, the FOMC decided to accelerate the release of the minutes publishing them three weeks after each meeting, as a way to provide further information on the committee's views on the economy. Apart from these changes, the content of the minutes has remained broadly stable in the period analysed; in this respect, the documents constitute a standardised form of communication which is useful to study the committee's official account of policy decisions.

Along with the minutes, since November 1993 the committee has released verbatim transcripts of the policy meetings with a five-year lag. As detailed in Meade and Stasavage (2008), Schonhardt-Bailey (2013) and Hansen, McMahon, and Prat (2018), among others, the decision to allow publications of the documents was due to legisla-

[24] See for example policy discussions on 16 November 1993 (FOMC Transcripts 16/11/1993: 12-19); on 28 October 2003 (FOMC Transcripts 16/11/1993: 107-08); and 9 December 2003 (FOMC Transcripts 16/11/1993: 111-13).

tive pressures. It largely represented a response to calls from politicians, particularly Senators Riegle and Gonzáles, to increase the transparency of the policy process (e.g., House of Representative Hearing 7/10/1993: 3-7). As a result of these pressures, the committee agreed to the immediate release of the transcripts dating up to 1988 as well as those moving forward, with a five-year lag. Differently from the minutes, which constitute the committee's official account of the rationale underlying policy decisions and are released weeks after each meeting; the transcripts report the full text of the policy discussions (with minor editing[25]) and are released at the end of each calendar year. As explained below, this particular feature of the communication policy of the FOMC allows comparing the content of the transcripts with the information included in the minutes to derive consistent measures of the committee's disclosures.

2.3.2 FOMC legislative oversight

The Federal Reserve is accountable to the US Congress.[26] Decision-making internal to the committee involves macroeconomic analysis and technocratic expertise and does not respond to partisan cycles (Binder and Spindel 2016); accordingly, the Fed is often considered one of the most independent agencies in the US Federal system (Schonhardt-Bailey 2013). Yet Congress has the power to enact legislation to restrict the committee's autonomy, and, especially in uncertain economic times, the committee faces significant challenges in the form of audits; requests to appear in hearings on specific policy topics before Congress; and threats of punitive legislation (Schonhardt-Bailey 2013; Broz 2015; Binder and Spindel 2016). The Fed's budget is not subject to Congressional approval but, according to a former FOMC member, "the threat that it could be remains real" (Axilrod 2013: 26). The importance of legislative support for the committee's ability to conduct policy is also often acknowledged by senior members in public speeches.[27]

An important way in which supervisory functions are carried out by Congress mem-

[25]Omitted information concerns mostly the names of individuals and companies mentioned in the discussions.

[26]See `https://www.richmondfed.org/faqs/frs`.

[27]During a hearing before Congress in 2004, Alan Greenspan stated that "We don't have any capability whatsoever to do anything without the agreement or even the acquiescence of the Congress of the United States." (Hearing 11/02/2004: 26); at a press conference held on 18 December 2013, Ben Bernanke similarly suggested that "I think the first thing to agree to is that Congress is our boss." (Press Conference Transcripts 18/12/2013: 28-30).

bers is through recurring public hearings of FOMC officials. In particular, since the Full Employment and Balanced Growth Act of 1978 (named 'Humphrey-Hawkins' after its sponsors, Senators Hubert Humphrey and Augustus Hawkins), the Chair of the FOMC is required to appear before the Congress Senate and House Banking Committees twice a year, in February-March and July-August, to clarify the rationale underlying monetary policy decisions. Although the legal obligation for these testimonies was terminated by the Federal Reports Elimination and Sunset Act of 1995, the FOMC and Congress agreed to continue holding the hearings given that, according to a source, they "had provided an effective means to explain... policies to Congress" (Transcripts 09/02/1999). As a result, these hearings constitute a recurring form of oversight of the Fed. In addition, their legal origin implies the occurrence of Humphrey-Hawkins testimonies is unrelated to the broader economic and financial conditions in which decisions take place; the next section discusses how this feature of Congressional oversight can be used to distinguish the role of political monitoring in communication.

Several examples suggest that politicians generally see the disclosures of the FOMC as important to understand its decisions. Legislative proposals in the past have sought to increase the amount of information about Fed decisions available to Congress; examples include the aforementioned Humphrey-Hawkins Act, the Federal Reserve System Accountability Act of 1993 and, more recently, the Federal Reserve Transparency Act of 2015 (Broz 2015). In addition, elected representatives often call for greater transparency during committee hearings (Schonhardt-Bailey 2013); consider for example the following comments advanced by Sen. Paul Sarbanes on 7 October 1993:

> "[O]n the issue of transparency and openness, it seems clear to me that some way must be found to provide more information to the public about the activities and the decisions of the Federal Reserve. [...] The way the system now works, as a matter of fact, is members of the Open Market Committee could make absolutely disastrous judgments about what policy ought to be and you will never know it." (Hearing 07/10/1993, p. 11)

Similarly, on 19 July 2006 Sen. Ted Bunning remarked to FOMC Chairman Ben Bernanke that:

> "There is still a problem with understanding what the Fed is thinking though totally. You have thought about bringing back the balance of risk statements

> or doing something else so people can understand what is going through all of your heads. [...] Is that going to happen?" (Hearing 19/07/2006, p. 44)

These quotes suggest that politicians in Congress actively seek to extract information about FOMC's decisions as a way to assess the quality of its policies, which is in line with the theoretical framework.

In addition, transcripts of Congressional hearings of the Fed suggest that political attention on the committee increases in moments when of economic uncertainty, when the Fed's decisions become politically more salient and politicians' incentives for monitoring its actions increase (Binder and Spindel 2016).[28] Supporting this view, news articles expressing concerns with the Fed's decisions are often cited by members of supervisory committees when asking for details about specific FOMC's policies and their expected outcomes. On 21 July 1992, for example, Sen. Sarbanes cited a New York Times article saying that during a testimony FOMC Chairman Greespan would have tried "to explain to Congress this week why the central bank's efforts have not succeeded" in lifting unemployment (Hearing 21/07/1992, p. 23); similarly, on February 14, 2007, Sen. Bunning mentioned an article appeared in the Washington Post which described the "inversion of the yield curve for 8 straight months and how local banks [...] were having difficulty [...]", asking whether FOMC policymakers were taking this factor into account (Hearing 14/02/2007, p. 26). Both examples suggest that media coverage of economic trends generally predicts political scrutiny of Fed policies;[29] this supports the view that political oversight of the FOMC generally varies with the political salience of its decisions.

Taken together, these dynamics of Congressional oversight of the Fed appear consistent with existing accounts of monitoring discussed above (e.g., McCubbins and Schwartz 1984). In line with the theoretical framework, it appears that legislators in Congress make active use of the FOMC's accounts to assess policy outcomes; moreover, legislative attention to the committee's policies varies with the political salience and media coverage of FOMC's decisions. This suggests it is possible to use these variables to evaluate the effect of political oversight on the committee's communication behaviour. I now turn to investigate this point in greater detail.

[28] For example, during the Senate Banking committee hearing of 21 July 1992 when, amid persistently high unemployment, Sen. Riegle requested "some new candor from the Fed", noting how "a mere repetition of what we've heard will not do" (Hearing 21/07/1992: 1).

[29] For additional examples see for example Hearing 11/02/2004 (p. 20 and 22-23) and Hearing 17/08/2006 (p. 27 and 44).

2.4 Research design

Proposition 2 holds that, if transparency matters for accountability, we should expect bureaucratic organisations to release more information about their decisions in moments when political monitoring of their policies increases. Testing this implication requires, first of all, data and methods to distinguish the effect of political monitoring from other factors which might be associated with it and still drive the committee's communication behaviour. Secondly, it requires constructing meaningful measures of the amount of information released by the committee to be used for the statistical analysis. In the remaining part of this section, I address these two issues in turn. The following section then engages more in detail with the data used in the analysis.

2.4.1 Empirical approach

Following the description of Congressional oversight of the Fed provided above, my main predictor of legislative scrutiny is the amount of news coverage of macroeconomic policy around policy meetings, a commonly-used measure of political salience in the public administration literature (e.g., Carpenter 2002; Walgrave and Van Aelst 2016). I compute the logarithm of the three-day average of the Economic Policy Uncertainty Index developed by Baker, N. Bloom, and Davis (2016, BBD henceforth), calculated ahead of a meeting t (denoted as $News_t$). This indicator tracks media coverage of macroeconomic policy in major US newspapers; more precisely, the authors count the number of articles containing triplets of the terms (i) "uncertain" or "uncertainty"; (ii) "economic" or "economy" and (iii) one or more economic policy-related terms.[30] The resulting values are then standardised and averaged across newspapers, providing an intuitive way to assess variations in salience of macroeconomic policy at specific points in time. To the extent that legislative oversight is driven by political salience, we should expect this measure to be positively correlated with the disclosures of the FOMC. This suggests using a regression of the form:

$$y_t = \alpha + \beta_1(\mathrm{News_t}) + X_t'\boldsymbol{\gamma} + T_t'\boldsymbol{\delta} + \varepsilon_t; \tag{2.6}$$

[30]Terms related to monetary policy; healthcare; tax regimes; trade; financial regulation; and government spending, see Baker, N. Bloom, and Davis (2016) for a full description.

where y_t is the level of information released by the FOMC in the minutes for meeting t (discussed below); X_t is a vector of macroeconomic and institutional controls (outlined in Section 2.5); and T_t are the relevant time effects. In this case, β_1 gives the variation in the amount of information released by the committee in response to variations in the public salience of its decisions. Following the theoretical discussion, we should expect this coefficient to be positive: higher salience should be associated with an increase in disclosure as the committee responds to an expected increase in political scrutiny.

While an intuitive way to assess the FOMC's responsiveness to drivers of political oversight, model (2.6) has the drawback that the level of salience is likely to depend also on several economic and institutional factors to which the committee might respond in its communications. To address this point, I use the timing of the Humphrey-Hawkins testimonies in US Congress to analyse how the effect of newspaper coverage varies as a function of the time distance to a hearing. As noted, both the schedule of the policy meetings and that of the semiannual testimonies is fixed in advance and unrelated to the broader conditions in which the committee's operates. This allows analysing the effects of newspaper coverage as a function of the length of time to a testimony to study the role of oversight on communication. If the committee responds specifically to expected levels of legislative monitoring, the effect of newspaper coverage should be stronger close to a testimony, when politicians' attention to the announcements of the FOMC is likely to be higher. Because the timing of the testimonies does not depend on public salience of the policy meeting itself, any variation in the impact of media coverage on communication behaviour can be safely attributed to the occurrence of a hearing.

More precisely, let the variable *DistHearing* define, for a meeting t, the number of future meetings before a Humphrey-Hawkins testimony in Congress is scheduled. The relevant effects can be estimated using the regression:

$$y_t = \alpha + \beta_1(\text{News}_\text{t}) + \beta_2(\text{DistHearing}_\text{t}) + \beta_3(\text{News}_\text{t} \times \text{DistHearing}_\text{t}) + X_t'\boldsymbol{\gamma} + T_t'\boldsymbol{\delta} + \varepsilon_t. \tag{2.7}$$

Differently from model (2.6), which estimates the unconditional relationship between newspaper coverage and disclosures, equation (2.7) analyses this effect taking the occurrence of a testimony into account. In this case, the coefficient of interest is β_3, which gives variations in the disclosure variable y_t in response to an increase in salience, as a function of the length of time between a policy meeting and a Humphrey-Hawkins testimony in Congress. Note that, given how the variable *DistHearing* is constructed,

the expected sign of the interaction term coefficient is negative (high media salience is associated with greater disclosure when *DistHearing* is low).

To favour interpretability, I complement this model with the following specification:

$$y_t = \alpha + \beta_1(\text{News}_\text{t}) + \beta_2(\text{D}(\text{Hearing}_\text{t})) + \beta_3(\text{News}_\text{t} \times \text{D}(\text{Hearing}_\text{t})) + X_t'\boldsymbol{\gamma} + T_t'\boldsymbol{\delta} + \varepsilon_t; \tag{2.8}$$

where *D(Hearing)* is a binary variable taking the value of 1 if a meeting takes place two meetings or less before a testimony (that is, if *DistHearing* $\leq$ 2) and 0 otherwise. In practice, model (2.8) compares the effect of media coverage on the information released by the committee before and after a testimony. This allows deriving additional evidence concerning the role of political monitoring on communication: if accountability matters, we should expect a greater effect of newspaper coverage right before a hearing, when political attention to the committee's messages is likely to be high. This implies that, on average, the coefficient on the interaction term β_3 in model (2.8) should be positive (high media salience is associated with greater disclosure ahead of a testimony).

Below, I report results from all the above models to study variations in the communication behaviour of the FOMC. As discussed, the advantage of regression models (2.7) and (2.8) is that, by focusing on the distance to a semiannual testimony, they allow to distinguish the effect of legislative oversight on the committee's communication behaviour. An important question, however, is to what extent results obtained with this strategy can be extended to different forms of Congressional oversight. I go back analysing this point in the empirical study, where I use alternative proxies of legislative scrutiny as a robustness check. As discussed below, these additional tests allows to better study the mechanisms relating patterns of oversight to FOMC's disclosures.

2.4.2 Measuring disclosures

Estimating models (2.6) - (2.8) requires a measure of y_t, the amount of information about policy decisions released by the committee. I use methods from computational linguistics to do this. First of all, I follow Acosta (2015) and measure disclosures for meeting t as the degree of semantic similarity between the FOMC minutes for any given meeting and the transcripts for the same meeting. In Section 2.7, I complement this approach using a different measure of the information contained in specific documents as a way to validate the empirical results.

The idea underlying the method is that, if the transcripts offer an accurate depiction of the decision-making process (or at least, more accurate than the minutes), greater semantic similarity between the transcripts and the minutes should indicate that the deliberations internal to the committee are reported more accurately in the minutes. Thus, a higher (lower) degree of similarity between the transcripts for a meeting and the minutes for the same meeting indicates that a higher (lower) amount of information is released by the FOMC in its communications. Following existing literature, this concept can be captured by the frequency with which certain terms occur in the text (Bholat et al. 2015). More precisely, let us assume that the documents released by the FOMC (the minutes or transcripts for a particular policy meeting) can be represented as a vector $\mathbf{d}_t$, which entries corresponds to the frequency of a unique term w occurring in that document. The full set of minutes and transcripts can thus be represented as document-term matrix D, with number of rows equal to number of documents and number of columns equal to the number of unique words V occurring in all documents. Starting from this notation, it is possible to define $\mathbf{d}_{t,min}$ and $\mathbf{d}_{t,trs}$, the vectors corresponding to the minutes and the transcripts for meeting t.

The estimate of the committee's disclosure for a specific meeting is given by the similarity between these two vectors. In particular, to measure transparency it is possible to compute the level of *cosine similarity* between the vector representation of the minutes and the transcripts for meeting t (Manning, Raghavan, Schütze, et al. 2008; Acosta 2015):

$$y_t = \frac{\mathbf{d}_{min,t} \cdot \mathbf{d}_{trs,t}}{|\mathbf{d}_{min,t}| \cdot |\mathbf{d}_{trs,t}|}. \tag{2.9}$$

The resulting index, ranging between 0 and 1, constitutes a measure of the committee's disclosure (y_t), where higher (lower) values indicate higher (lower) transparency. Note the measure above is insensitive to overall document dimensions, which is useful to account for changes in the length of the documents over time.

The cosine similarity measure in (2.9) has the key advantage of providing a meaningful estimate of the committee disclosures about the decision-making process which can be used in the statistical analysis. However, it has two drawbacks that is worth discussing briefly. First of all, by construction the indicator ignores the order in which words appear in the text: this makes it difficult understand how particular terms are used in the documents (Grimmer and Stewart 2013; Schonhardt-Bailey 2015). Yet it

can be argued that, because the minutes and the transcripts are very different texts – representing respectively an official communication and the raw transcripts of policy deliberations– in this context it might make sense to focus only on the frequency of specific terms. Doing so allows assessing whether the two texts refer to the same set of issues, which is consistent with recent studies on the FOMC (Hansen, McMahon, and Prat 2018).

A second issue issue is that the cosine similarity measure (2.9) does not allow understanding whether changes in the indicator of disclosure come from variations in communication (more informative minutes) or from changes in the content of the transcripts. This is particularly important given that, in theory, variations in political scrutiny might also lead policymakers to engage in strategic behaviour (Stasavage 2004; Prat 2005). For example, previous contributions have noted policymakers might react to increase in visibility by limiting the information exchanged during the meetings to avoid the risk of being perceived as incompetent (Meade and Stasavage 2008; Hansen, McMahon, and Prat 2018); in this case, variations in (2.9) might in fact indicate a loss of information included in the transcripts (Acosta 2015). To address this point, below I complement the cosine similarity measures of transparency with a different metric that allows to assess the effect of oversight on the level of information included in the minutes in the FOMC minutes and transcripts separately. As further discussed in Section 2.8, I also perform various tests to evaluate the effect of oversight on the deliberations internal to the committee.

2.5 Data

2.5.1 Communication data and pre-processing steps

My dataset includes the minutes and the transcripts of the policy meetings in the period from 2 November 1987 (the beginning of Alan Greenspan's tenure as FOMC Chair) to 31 December 2010, a total of 416 documents. In all cases, documents are obtained from the website of the Fed's Board of Governors[31] and converted to a common text format prior to the analysis. I have then used regular expressions to clean documents from encoding strings, and applied a series of standard pre-processing steps to the text aimed

[31] See `https://www.federalreserve.gov/monetarypolicy/fomccalendars.htm`

at reflecting the substantive meaning of the documents Grimmer and Stewart 2013). For each document, I have:[32]

- Merged collocations, namely group of words which meaning differs from that of the individual terms (e.g, *housing*, *prices* $\rightarrow$ *housing_prices*);[33]
- Removed non-alphabetical characters and numbers from the text;[34]
- Converted all alphabetical characters to lower case;
- Removed a list of "stop words" from the documents. These include recurring words which add little to the substantive meaning of the text (articles, pronouns), as well as the names of participants and those of the various Federal Reserve branches.[35]
- Reduced the resulting terms to their common roots (e.g., *pricing*, *prices* $\rightarrow$ *pric*).

I have then weighted the frequency of the resulting terms using the term frequency-inverse document frequency (*tf-idf*) scheme. This method assigns high weight on terms which appear many times in few documents and low weights on terms which occur few times in a document, or very often across documents (Bholat et al. 2015), thus giving greater weight to those words which contribute the most in discriminating among documents.[36] The weighted document-term vectors are then used to extract the level of cosine similarity from the text.

[32]Pre-processing steps have been applied using the `quanteda` package written by Benoit, Watanabe, et al. (2016) for R; the same package has been used to derive cosine similarity measures.

[33]The G^2 criterion defined by McInnes (2004) has been used for this purpose; the 500 most likely collocations according to this criterion have been merged together.

[34]Before doing this, abbreviations for monetary aggregates were converted to alphabetical characters (e.g, M2 $\rightarrow$ *M_TWO*).

[35]The full list is reported in the Appendix.

[36]This weighting scheme assigns to word w in document d a score

$$\text{tfidf}_{w,d} = [1 + log(f_{w,d})] \left(\frac{D}{d_{f,Tot.}} \right)$$

Where $f_{w,d}$ is the frequency of a term within a document and $d_{f,Tot.}$ is the total number of documents in which the term occurs (see also Manning, Raghavan, Schütze, et al. 2008).

2.5.2 Controls

The vector of controls X_t in regression models (2.6) - (2.8) includes, first of all, a binary indicator for the occurrence of dissenting votes.[37] This variables offers a broad proxy of internal disagreement at specific meetings, thus allowing to investigate the effect of dissent on transparency. Intuitively, we should expect greater disagreement to be associated with additional communication efforts as the committee seeks to clarify the various positions expressed during the meeting; yet it is also possible that policymakers prefer avoiding conveying conflicting signals, as a way to limit uncertainty (e.g., Blinder, Ehrmann, et al. 2008). In the latter case, we should expect a negative regression coefficient on this variable. Beyond dissenting votes, I include binary indicators for the committee's Chair and the occurrence of NBER recessions, to control for the influence of these factors on the committee's communication policy.[38]

As additional controls, I include one- and two-quarters ahead forecasts for GDP, inflation and unemployment as reported in the Federal Reserve's 'Greenbook'. This document is prepared by the Fed's staff and distributed among participants several days before each meetings, thus constituting a summary of the set of information concerning the main economic aggregates at the time of the meeting (Meade and Stasavage 2008; Coibion and Gorodnichenko 2012); including these series allows evaluating the effect of macroeconomic trends on the committee's transparency. I also consider dummy variables taking the value of 1 of after November 1993, when the committee first agreed to publish the transcripts, and a binary variable taking the value of 1 after December 2004, when the committee anticipated the release of the minutes. Several additional controls are discussed in Section 2.9 below. Note however that, if the timing of the testimonies is actually independent from underlying economic conditions, we should see little change in the estimates of the main effects (β_3 in regression models [2.7] and [2.8]) after introducing the controls.

Finally, to account for time effects in FOMC's communication behaviour, the vector T_t includes binary variables for years and months; these variables control for the possibility that specific events (release of economic forecasts, economic events taking place in specific years) affect the estimates of the relevant coefficients. In all models, I

[37] Data on dissenting votes are obtained from Thornton and Wheelock (2014).

[38] Beechey and Österholm (2007) and Bailey and Schonhardt-Bailey (2008) find a significant effect of the committee Chair on policy outcomes; for an assessment of the role of recessions on the communication policy, see Blinder, Ehrmann, et al. (2008) and Hansen and McMahon (2016).

also include a lagged dependent variable to control for autocorrelation in communication behaviour. To account for heteroskedasticity in the data, all models are estimated using robust standard errors. Flexible time trends and alternative ways to address heteroskedasticity are considered in Section 2.9 below.

2.6 Empirical results

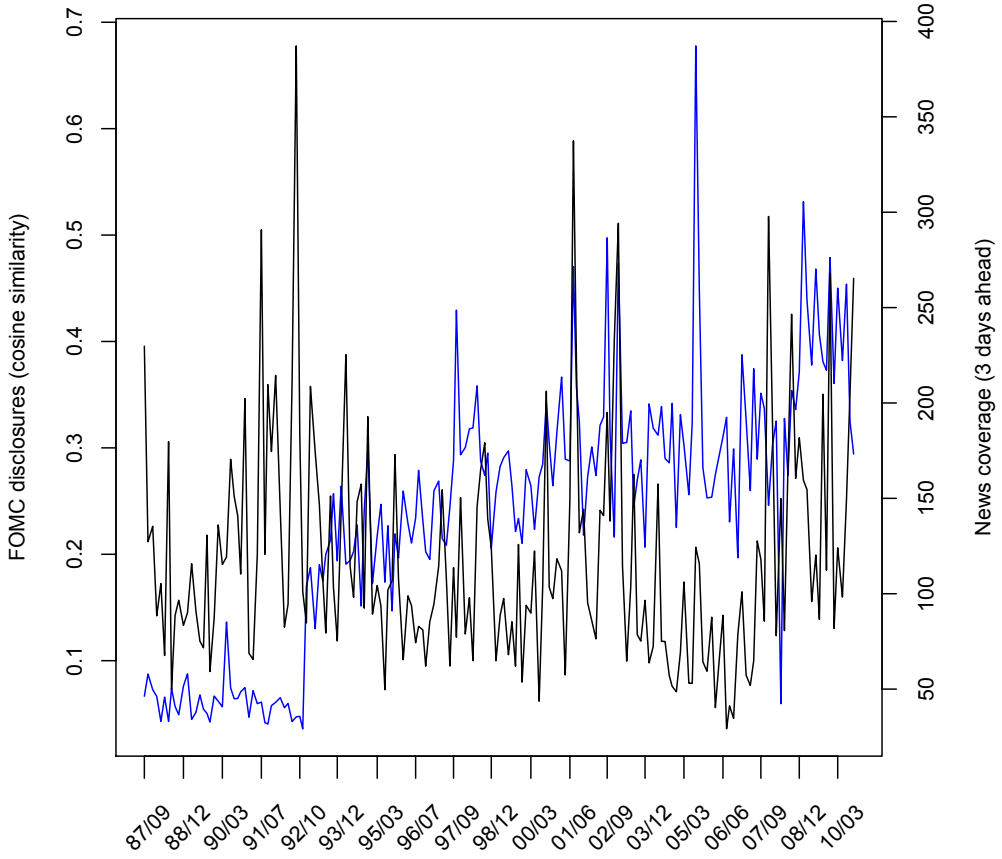
I now present empirical evidence concerning the responsiveness of FOMC's disclosures to drivers of political oversight. In this section, I first discuss stylised trends and illustrate the main regression results obtained using the cosine similarity measure of FOMC's disclosures; I then I repeat the analysis using alternative measures of political scrutiny, as a way to provide further evidence concerning the role of legislative oversight. Sections 2.7 and 2.8 investigate the robustness of these results by using document-specific measures of disclosures, as well as by investigating the impact of legislative oversight on the policy deliberations internal to the committee. Results for various standard robustness tests (e.g., time trends and models specification) are discussed in Section 2.9.

2.6.1 Stylised trends

Figure 2.1 plots trends in the cosine similarity measure of transparency (blue line) as well as those for the newspaper coverage ahead of each meeting, the *News* variable (black line). Several features stands out. First of all, both series exhibit substantial variation in the sample period. In the data, the cosine similarity measure has a mean value of the 0.18 and a standard deviation of 0.1, while the *News* variable has a mean value of 103.80 and a standard deviation of 58.36. Therefore, at least judging by these measures, there appears to be a significant variation in both public salience and information released by the committee over time; in particular, the relatively large standard deviation for cosine similarity suggests the committee actively adjusts the amount of information it releases to the public from one meeting to the next.

In addition, the cosine similarity series exhibits higher values following large external events which are likely to have dominated internal discussions. An example is constituted by the meeting taking place on 20 September 2005, following devastation of the Gulf Coast region by Hurricane Katrina. In this case, a significant part of the

Figure 2.1: Trends in cosine similarity and newspaper coverage, 1987-2010



The figure shows trends in the cosine similarity measure of transparency (blue line) and average newspaper coverage of macroeconomic policy news for the three-day ahead of each meeting (black line). Macroeconomic news coverage is taken from BBD.

policy discussions was focused on the potential impact of the hurricane on output and inflation, which figures also prominently in the minutes for the meeting;[39] reflecting the similar focus of the two documents, the cosine similarity value between the minutes and transcripts is relatively high, at approximately 0.68. A similar example is constituted by the meeting of 18 March 2003, which took place before the invasion of Iraq; in this case, the committee included in the minutes a detailed overview of the uncertainties re-

[39]In the minutes, there were 20 mentions of "hurricane", 9 mentions of "Katrina", 6 mentions of "storm", and 2 mentions of "landfall". In the transcripts, the string "Hurricane Katrina" alone was mentioned 84 times.

lated to this event, which were previously discussed in the policy meeting.[40] Also in this case, the cosine similarity measure is quite high, at around 0.6. In both circumstances, it would be reasonable to expect greater disclosures as the committee explains to the public how it intends to responds to the event. The fact that variations in cosine similarity are consistent with this expectation provides an intuitive check concerning the validity of this measure.

More interestingly, for the overall argument, Figure 2.1 clearly shows a positive correlation between transparency and newspaper coverage. This indicates that increases in the public salience of the decision of the FOMC are associated with additional information released by the committee in its minutes. While the effect can be driven by factors different from (or including) oversight, these stylised trends suggest that the FOMC tends to become more transparent in moments when it is reasonable to expect political monitoring to increase. This accords with the research hypotheses as well as with the theoretical argument concerning the effect of oversight on public agencies' communication behaviour.

2.6.2 Main results

More robust evidence is included in Table 2.1. In columns (1) and (2), I report OLS estimates obtained regressing the cosine similarity index against newspaper coverage as well as the various time and institutional controls (equation [2.6]). As shown, there is a positive and robust correlation between the two variables, thus confirming the trends described in Figure 1. In addition, the coefficient on *News* remains significant irrespective of the introduction of the controls. Further regressions using standardised variables to estimate model (1) suggest that one standard deviation in newspaper coverage is associated with 1.3% to 1.4% increase in disclosure. However, note that when control variables are introduced in the regression, the estimated coefficients on newspaper coverage become much smaller. As discussed, such an effect is to be expected given that *News* is likely to be correlated with the broader economic and financial conditions in which decisions take place; this limits the possibility of using these tests to make inference about oversight with respect to the committee's communication behaviour.

[40]The internal discussions focused in particular on the potential impact on energy prices (Nelson and Katzenstein 2014). In the minutes for the meeting of 18 March 2003 there are 7 mentions of the term "Iraq*" 5 mentions of "geopolitical"; and 16 mentions of "uncert*".

Table 2.1: Results for cosine similarity

	(1)	(2)	(3)	(4)	(5)	(6)
News	0.037***	0.029***	0.062***	0.055***	0.013	0.002
	(0.013)	(0.011)	(0.017)	(0.016)	(0.016)	(0.014)
DistHearing			0.088**	0.130***		
			(0.034)	(0.037)		
D(Hearing)					−0.200***	−0.246***
					(0.077)	(0.078)
News × DistHearing			−0.013**	−0.015**		
			(0.005)	(0.006)		
News × D(Hearing)					0.037**	0.039**
					(0.016)	(0.017)
Dissenting votes (binary)	0.019*	0.022**	0.019*	0.022**	0.019*	0.023**
	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)
NBER recession (binary)		0.022**		0.017		0.020*
		(0.011)		(0.011)		(0.011)
Lagged Dep. Var.	−0.001	0.020	−0.006	0.027	0.0001	0.034
	(0.087)	(0.094)	(0.086)	(0.093)	(0.087)	(0.094)
FOMC Chair (binary)	Yes	Yes	Yes	Yes	Yes	Yes
Post-November 1993 (binary)		Yes		Yes		Yes
Post-December 2004 (binary)		Yes		Yes		Yes
Greenbook forecasts (1 and 2-quarters ahead)		Yes		Yes		Yes
Year (factor)	Yes	Yes	Yes	Yes	Yes	Yes
Month (factor)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	176	176	176	176	176	176
R^2	0.861	0.872	0.864	0.878	0.885	0.878
Adjusted R^2	0.821	0.826	0.823	0.832	0.841	0.830

Note: *p<0.1; **p<0.05; ***p<0.01

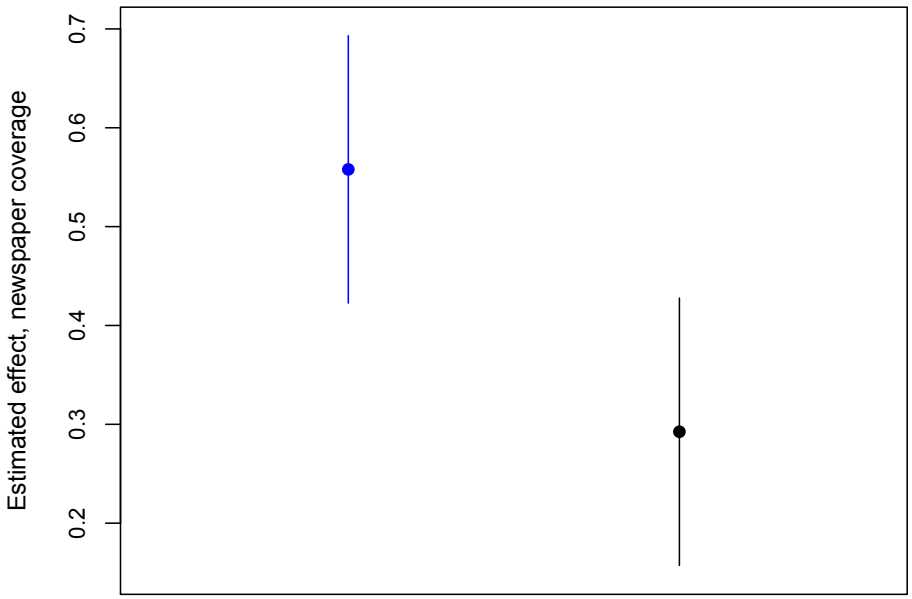
The table shows OLS estimates for the cosine similarity measure of FOMC's disclosures. Constant term included but not shown in output. Macroeconomic news coverage taken from BBD. Robust standard errors shown in parentheses.

To distinguish the role of political monitoring, I turn to variations in the effects of newspaper coverage as a function to the proximity to Humphrey-Hawkins testimonies in Congress as outlined in Section 2.4. In models (3) and (4) in Table 2.1, I introduce the *DistHearing* variable and interact it with *News* (equation [2.7]). Recall that, if the committee reacts to political oversight, the sign of the interaction term should be negative. Accordingly, the Table shows a negative and significant interaction effect; this confirms the importance of oversight for the committee's disclosures. In other words, the committee discloses more information in response to a shift in media attention, when the policy meeting takes place close to a Humphrey-Hawkins testimony. As discussed, there is little reason to believe that the occurrence of a hearing is determined by underlying economic and institutional conditions which we can expect to affect newspaper coverage, suggesting that the committee's responds to political scrutiny in its communication policy.

Consistent estimates are included in Columns (5) and (6), which use the binary variable *D(Hearing)* to measure the effect of public salience ahead of testimonies (equation [2.8]). As shown, the interaction term is positive and significant, which confirms the importance of oversight for the communication behaviour of the committee. An intuitive way to interpret these results is that the effect of an increase in media coverage on the FOMC's disclosures is higher ahead of a testimony; again, this is consistent with the research hypotheses. To favour interpretation, I report a graphical illustration of the relevant effects in Figure 2.2. The chart uses standardised values on the main variables to compare estimated effects of one standard deviation in newspaper coverage for meetings right before and after a testimony. As shown, the impact of political salience is significantly higher before a to a testimony; more precisely, my estimates suggests that one standard deviation increase in salience leads to a 6% increase in FOMC transparency ahead of a hearing, as opposed to 3% after the testimony has taken place. In this respect, the impact of oversight on FOMC's disclosures appears substantial; in line with expectations, it results that the committee consistently adjusts its communications to the expected level of political scrutiny.

Other covariates behave as expected. The results in Table 2.1 indicate a positive correlation between recessions and transparency, as well as between dissenting votes and disclosures. The latter finding is interesting given that it suggests that internal dissent (manifested in contrarian votes) tends to be reflected in greater transparency, an effect which I further investigate in the next section. In addition, the coefficients on

Figure 2.2: Effect of public salience as a function of legislative oversight



The figure shows the estimated effect of one standard deviation in newspaper coverage of macroeconomic news on FOMC's transparency, for meetings before (blue) and after (black) Congressional testimonies. Macroeconomic news coverage taken from BBD.

the lagged dependent variable are consistently not significant: this confirms that the FOMC substantially adjusts its communication structure from one meeting to the next, which accords with the trends in Figure 1. Other controls (not shown) including the binary variable for the committee's Chair and CPI forecasts included in the 'Greenbook', are significant. In particular, the binary indicator for the tenure of Alan Greenspan as FOMC Chair is positive: this is consistent with existing accounts of Fed's communication policies, which generally underscore a shift towards greater transparency during Greenspan's tenure (e.g., Blinder, Ehrmann, et al. 2008). Note however that adding the control variables does not substantively change estimates for the main interaction term used to evaluate the effect of oversight. This reinforces the idea that this variable is uncorrelated with underlying economic and political conditions and validates the overall research strategy.

2.6.3 Alternative measures of oversight

To investigate the mechanisms driving the above results, I complement the distance from semiannual testimonies with two alternative measures of oversight. First of all, I use Broz's (2015) data on Congressional bill proposals concerning Fed independence. The dataset includes all proposed legislation since 1973 that would require the Fed to be subject to more scrutiny by the General Accountability Office (GAO), thus offering a direct measure of Congress' attention to the FOMC's decisions at specific points in time.[41] I create a binary variable *D(Bill)* taking the value of 1 if a specific policy meeting is the first meeting taken place following the proposal of a bill in Congress, and 0 otherwise. Because the GAO's authority includes reviewing implementation and effects of agencies' policies, bill proposals related to expanded auditing functions can be taken as a broad proxy of the level of political scrutiny of FOMC's policies (Broz 2015; Labonte 2016). Accordingly, I anticipate a positive interaction effect between *D(Bill)* and newspaper coverage in determining the level of FOMC disclosures.

As a further measure of oversight, I use the overall frequency of Congress' hearings close to FOMC meetings. These include Humphrey-Hawkins testimonies as well as additional hearings in US Congress related to monetary policy. More precisely, I construct an additional equal to the total number of Congressional hearings on monetary policy which have taken place on the same month of a FOMC's policy meeting,[42] treating the resulting variable as an additional proxy for political attention to the FOMC's decisions. If the committee responds to expected levels of legislative oversight, we should expect the correlation between media salience and transparency to be higher in months in which more hearings on monetary policy are scheduled, given that in these circumstances political scrutiny of its decisions will be higher. Also in this case, therefore, I anticipate a positive interaction between the index of newspaper coverage and the overall number of hearings.

Relevant results are reported in Table 2.2. As shown, there is a positive interaction

[41] Since the Federal Banking Agency Audit Act (P.L. 95-320) of 1978, the GAO has the power to audit the Fed's non-monetary functions, for example related to its regulatory duties, while its monetary decisions are not subject to audit. for an overview of the legal framework for GAO audit of the Fed, see Broz (2015).

[42] For this, I use the Comparative Agendas Project database (CAP, see `https://www.comparativeagendas.net/`). I focus on hearings related to the CAP topic 104 ('Macroeconomics – Monetary Policy'), dropping all observations related to the Treasury's appropriations.

effect between the measure of media salience and the proxies for legislative scrutiny, which confirms a positive link between levels of legislative oversight and FOMC's disclosures. In the case of bill proposals, the interaction effect is highly significant ($p < 0.01$) when the economic controls are not included in the regression (Column [1]), but it becomes somewhat less significant ($p \sim 0.07$) when economic controls are included (Column [2]). A potential explanation is that, as shown by Broz (2015), bill sponsorship are relatively rare in the sample and most of them have taken place in specific years at the beginning and at the end of the period considered.[43] Considering these limitations, therefore, it is possible to argue that results in columns (1) and (2) are broadly in line with those discussed in the case of Table 2.1. Accordingly, in the case of Congressional hearings (columns [3] and [4]), the interaction term remains highly significant irrespective of the introduction of controls, suggesting a positive relationship between the additional measure oversight and the committee's disclosures. In both cases, therefore, the estimates suggest that higher legislative attention on the FOMC is associated with additional information released in the minutes.

Taken together, the results in Tables 2.1 and 2.2 reinforce the main argument concerning the effects of political oversight on the FOMC's disclosures. While a direct interpretation of the results reported in Table 2.2 is challenging given that various unobserved factors may drive the results,[44] both bill proposals and number of hearings arguably constitute direct forms of oversight which can be related to the accountability mechanism outlined in the theoretical discussion. In this respect, the results for these additional tests are largely consistent with those reported in Table 2.1, which uses instead a specific form of oversight (the distance from a semiannual testimonies) to identify effects. In all cases, it appears that the committee responds to an increase in political attention by varying the amount of information it releases in the minutes. These findings directly supports the idea that legislative scrutiny induces higher disclosures. Overall, the argument that variations in oversight determines an increase in public sector agencies' transparency finds strong support in the case of the FOMC.

[43] See Broz (2015), Appendix A. After 1987, 17 bill proposals were advanced in total. All proposals were made in the period from 1991 to 1995 and after the beginning of the financial crisis in 2008.

[44] For example, in the aforementioned study by Broz (2015), the author shows that politicians' support for expanded GAO functions for the Fed depends also on prevailing dynamics in inflation and output, as well as on how the Fed is addressing these two dimensions; a similar dynamic might be taking place in the case of hearings (Schonhardt-Bailey 2013).

Table 2.2: Alternative measures of oversight

	(1)	(2)	(3)	(4)
News	0.036^{***}	0.029^{**}	0.028^{**}	0.018^{*}
	(0.013)	(0.011)	(0.013)	(0.011)
D(Bill)	-0.533^{***}	-0.409^{*}		
	(0.206)	(0.230)		
News × D(Bill)	0.121^{***}	0.093^{*}		
	(0.045)	(0.052)		
Hearings (frequency/month)			-0.105^{**}	-0.115^{**}
			(0.049)	(0.052)
News × Hearings (frequency/month)			0.022^{**}	0.025^{**}
			(0.010)	(0.011)
Dissenting votes (binary)	0.020^{*}	0.022^{**}	0.019^{*}	0.022^{**}
	(0.011)	(0.010)	(0.011)	(0.010)
NBER recession (binary)		0.021^{**}		0.021^{**}
		(0.010)		(0.010)
Lagged Dep. Var.	0.003	0.026	0.0001	0.023
	(0.087)	(0.094)	(0.086)	(0.093)
FOMC Chair (binary)	Yes	Yes	Yes	Yes
Post-November 1993 (binary)		Yes		Yes
Post-December 2004 (binary)		Yes		Yes
Greenbook forecasts		Yes		Yes
Year (factor)	Yes	Yes	Yes	Yes
Month (factor)	Yes	Yes	Yes	Yes
Observations	176	176	176	176
R^2	0.862	0.873	0.863	0.876
Adjusted R^2	0.821	0.825	0.823	0.829
Note:				*p<0.1; **p<0.05; ***p<0.01

The table shows OLS estimates for the cosine similarity measure of FOMC's disclosure. Constant term included but not shown in output. Macroeconomic news coverage taken from BBD. Robust standard errors in parentheses.

2.7 Document-level analysis

As seen, a potential problem with the estimates above is that cosine similarity does not allow distinguishing the effect of the independent variables on the content of single documents: variations in cosine similarity can be driven by changes the content of the minutes, as we would expect in the case of greater transparency, or by changes in the information contained in the transcripts, which does not necessarily imply greater disclosure (Acosta 2015).

To evaluate these different dynamics, I repeat the main models focusing on the level of linguistic sophistication, or complexity, of specific documents. Specifically, for each document I extract the corresponding value of the Flesch-Kincaid (FK) index, a measure which gives variations in the overall 'ease' which specific documents can be read (e.g., Benoit, Munger, and Spirling 2019). This index is based on the number of words, sentences and syllables occurring in the text; for any document d, the relevant value is given by:

$$\mathrm{FK}_{\mathrm{t,d}} = 0.39 \times \frac{\text{words}}{\text{sentences}} + 11.8 \times \frac{\text{syllables}}{\text{words}} - 15.59. \tag{2.10}$$

A useful interpretation of (2.10) is the level of linguistic sophistication of specific documents (Benoit, Munger, and Spirling, cit.). For example, longer sentences to clarify specific actions result in an increase of the indicator; similarly, additional terms to make the view of the committee more precise raise the value of the FK index.[45] In general, this measure can be interpreted as the complexity of the documents analysed which, in the case of the FOMC's minutes, I relate to the level of information contained in the text. To clarify this approach, consider the following two examples:

(a) *"On January 31, the Board of Governors approved a reduction of 1/4 percentage point in the discount rate, to a level of 5 percent."* (FOMC Minutes, 26/03/1996). **FK index: 12.09.**

(b) *"In the Committee's discussion of policy for the intermeeting period ahead, most of the members preferred and all could support a further easing of reserve conditions consistent with a 50 basis point reduction in the federal funds rate, to 5 percent."* (FOMC Minutes, 10/03/2001). **FK Index: 20.25.**

[45] For example , the use of 'expect' instead of 'think', see Bulir, Cihak, and Jansen (2014).

The two sentences relate to similar concepts, namely the decision to lower the federal funds rate at specific meetings. However, sentence (b) contains additional details related to the policy discussions, particularly concerning the level of support for a reduction in policy rates among committee members. Accordingly, the FK value for this sentence is higher (it is equal 25.79 for sentence [b], as opposed to a score of 12.09 for sentence [a]). This example indicates that higher (lower) values for this index can be taken as representing additional (less) information disclosed in the minutes, an indication of how informative these documents are.

As a result, while the FK scale is undoubtedly less precise than cosine similarity to capture the FOMC's disclosures,[46] it provides an intuitive measure of the level of detail included in FOMC's communications. In this respect, the index constitutes a useful measure to test the robustness of the main results. With respect to cosine similarity, the FK index has the key advantage that it can be applied separately to the minutes and the transcripts of policy meetings; as discussed shortly, this allows to further analyse the mechanisms driving the results discussed in Section 2.6 above.

I report the relevant estimates in Table 2.3. For these tests, I focus directly on results obtained for the main specifications (2.7) and (2.8), including the full set of controls. Several features stand out. First of all, in the case of the minutes (Columns [1] and [2]) the coefficient on the interaction term between the measure of newspaper coverage and the distance from a semiannual testimony is highly significant. The interaction is positive when the distance from a Humphrey-Hawkins hearing is treated as continuous, while it is positive when the variable is treated as discrete; this indicates a positive effect of legislative scrutiny on the linguistic sophistication of the FOMC's minutes. As in the case of cosine similarity, therefore, there appears to be a direct relationship between the level of political attention and the amount of information released in the FOMC's minutes; both results indicate that, in moments of greater political scrutiny, the communications of the committee tend to become more precise. In addition, results in Table 2.3 suggest that political attention has little effect on the linguistic content of the transcripts. The complexity of these documents seems to increase moderately

[46] Because an increase in the FK index implies greater linguistic complexity (Bulir, Cihak, and Jansen 2014), an alternative interpretation is that higher values of the index represent an attempt by the committee of making its messages less clear. Such a dynamic appears unlikely, however, given the importance of FOMC communication for policy transmission, routinely stressed by senior FOMC members (e.g., Bernanke 2004; Yellen 2013). In any case, it should be stressed that the FK is used here mainly as a robustness test.

in moments of greater oversight (Columns [3] and [4]); but the interaction effect is consistently not significant. Thus while political attention has a positive effect on the level of sophistication of the minutes, it does not appear to affect the content of the transcripts. An intuitive explanation for these trends is that, in moments of greater political oversight, the language of FOMC's official communications tends to become more precise, while the complexity of the words used in the internal meetings does not vary substantially.

This dynamic is illustrated in Figure 2.3. The figure compares variations in the Flesch-Kincaid index for the minutes and the transcripts in response to public salience before and after a hearing (model [2.8]); also in this case, I use standardised variables to favour interpretability. As shown, there is a substantial difference on the impact of public salience on the level of complexity of the minutes and the transcripts. For the minutes, the estimated effect of newspaper coverage is very similar to what identified for cosine similarity: in particular, the impact of public salience is positive and significantly different from zero; moreover, the effect of media coverage is much higher before a testimony, again indicating a positive effect of oversight on disclosures. For the transcripts, the dynamic is very different: first of all, public salience does not appear to have any significant impact on the documents' complexity. Secondly, there is no variation in the effect of newspaper coverage as a function of the distance from the testimonies. Thus, the language used in the transcripts appears to vary little in response to variation in Congressional oversight.

These tests complement the analysis carried out with cosine similarity in several ways. First of all, they confirm that political oversight has a distinct effect on the level of information released by the committee; more precisely, they suggest that the main results are driven by variations in the content of the minutes, which become more similar to the discussions internal to committee *and* linguistically more precise in moments of greater oversight. Secondly, the results suggest that the dynamics of deliberation internal to the committee do not change in moments of greater scrutiny, given that neither the length nor the complexity of these documents vary with drivers of political scrutiny. A potential explanation for these dynamics is that oversight encourages greater communication without affecting the decision-making internal to the committee, something which I further investigate in the next section.

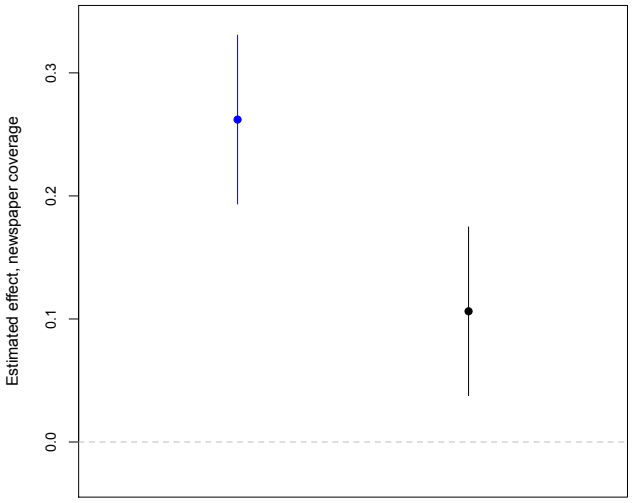
Table 2.3: Results for Flesch-Kincaid index

	Minutes		Transcripts	
	(1)	(2)	(3)	(4)
News	0.143	-0.364^{***}	-0.030	-0.058
	(0.152)	(0.133)	(0.136)	(0.103)
DistHearing	0.861^{**}		-0.004	
	(0.344)		(0.305)	
News × DistHearing	-0.134		-0.008	
	(0.057)		(0.050)	
D(Hearing)		-2.098^{***}		-0.062
		(0.758)		(0.599)
News × D(Hearing)		0.396^{**}		0.022
		(0.154)		(0.121)
Dissenting votes (binary)	0.131^{*}	0.133^{*}	0.087	0.087
	(0.078)	(0.078)	(0.065)	(0.065)
NBER recession (binary)	-0.172	-0.141	0.101	0.102
	(0.170)	(0.170)	(0.126)	(0.125)
FOMC Chair (binary)	Yes	Yes	Yes	Yes
Post-November 1993 (binary)	Yes	Yes	Yes	Yes
Post-December 2004 (binary)	Yes	Yes	Yes	Yes
Greenbook forecasts (1 and 2-quarters ahead)	Yes	Yes	Yes	Yes
Year (factor)	Yes	Yes	Yes	Yes
Month (factor)	Yes	Yes	Yes	Yes
Observations	176	176	176	176
R^2	0.706	0.708	0.918	0.918
Adjusted R^2	0.599	0.601	0.888	0.888
Note:				*p<0.1; **p<0.05; ***p<0.01

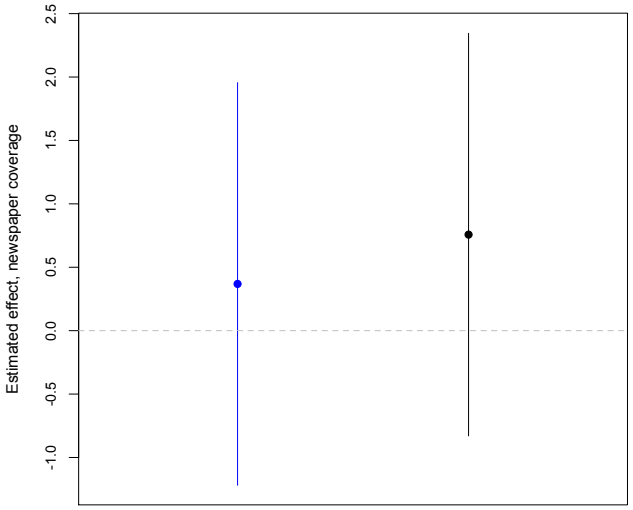
The table shows OLS estimates for Flesch-Kincaid values of FOMC's disclosures. Constant term included but not shown in output. Macroeconomic news coverage taken from BBD. Robust standard errors shown in parentheses.

Figure 2.3: Estimated effect of newspaper coverage, by document type.

(a) FOMC minutes



(b) FOMC transcripts



The figure shows the estimated effect of a one standard deviation in newspaper coverage of macroeconomic news on the Flesch-Kincaid measure of linguistic complexity, for meetings before (blue) and after (black) Congressional testimonies. Macroeconomic news coverage is taken from BBD.

2.8 Oversight and deliberation

To this point, the analysis has focused on the committee's communication behaviour; the empirical tests show that, at least in the case of the FOMC, legislative oversight has a positive effect on agencies' transparency. As a further robustness check, in this section I conduct additional tests to assess whether political scrutiny has any effect on the decision-making process internal to the committee.

Several contributions in political economy find that disclosure requirements might have adverse impact on deliberation by inducing policymakers to self-censor (Meade and Stasavage 2008; Hansen, McMahon, and Prat 2018). To the extent that oversight raises political attention to the committee's decisions, a similar dynamic might take place in response to legislative monitoring (e.g., A. S. Roberts 2005): as the political visibility of their decisions increase, committee members might be less willing to manifest their views during the meetings. Such an effect would not necessarily invalidate the empirical results above: at least in theory, oversight could both incentivise greater communication and hinder deliberation. Yet in practice, knowing whether political monitoring has an adverse effect on the decision-making process is important to assess the effects of oversight on public organisations' accountability (Hood and Heald 2006); in this respect, it seems relevant to investigate whether legislative oversight inhibits dissent within the committee.

As seen in Section 2.7, using document-specific measure of length and complexity I find no effect of oversight on the policy discussions reported in the transcripts. Here, I complement these tests with three additional measures of internal dissent. A first measure is the binary indicator for contrarian votes, already used as a control variable in the empirical tests above. The use of dissenting votes constitutes a direct way to assess disagreement within the FOMC at specific points in time (e.g., Thornton and Wheelock 2014); intuitively, if oversight leads policymakers to self-censor, we should be less likely to observe a dissenting vote in moments of higher political scrutiny. At the same time, using dissenting votes is potentially problematic given that contrarian votes have historically been relatively rare among FOMC policymakers.[47] Therefore, I complement voting data in two ways. First of all, from the meeting transcripts I extract the average number of interventions made by individual policymakers during a meet-

[47] Possibly, this is because members of the committee prefer to convey an impression of consensus when formulating policy (e.g., Meade et al. 2005; Schonhardt-Bailey 2013).

ing: lower values on this variable suggest that committee members participate less in the discussions, thus offering a way to study whether the greater visibility induce policymakers to remain silent. In addition, I compute a measure of verbal dissent which tracks, at any given meeting, the average similarity of individual members' statements with the remarks made by the FOMC Chair. A high degree of similarity between the committee Chair and other members suggest policymakers are merely repeating what the Chair is saying, which suggests lower dissent.[48]

For this, let $\chi_{C,t}$ define the document-vector representation of the full set of interventions made by Chair of the FOMC during meeting t; similarly, let $\chi_{i,t}$ represent the document vector for the interventions made by committee member i. Following the definition of cosine similarity in Equation (2.9), we can measure the similarity between the statement of the Chair and those an individual members as:

$$Sim_{C,i,t} = \frac{\chi_{C,t} \cdot \chi_{i,t}}{|\chi_{C,t}| \cdot |\chi_{i,t}|}, \tag{2.11}$$

Taking the mean of Equation (2.11) we then then obtain $\overline{Sim}_{C,i,t}$, the average measure of the voiced positions of individual policymakers during the meetings. As mentioned, higher values of $\overline{Sim}_{C,i,t}$ indicate policymakers tend to mimic the Chair's words; this offers an additional way to capture an eventual loss of overall dissent in the debate. Specifically, an increase (decrease) in the value of $\overline{Sim}_{C,i,t}$ indicates lower (higher) disagreement.

The relevant results are presented in Table 2.4. The table includes regression results for the main specification (equation 2.7) using the various measures of disagreement as dependent variables.[49] As shown, in no case the main interaction term is significantly correlated with the measures of dissent, which confirms that oversight has little effects on the various measures of deliberation. In fact, coefficients on the interaction term are consistently negative, particularly when the full set of controls is used in the regression, indicating the existence of a (not significant) positive correlation between the indicators of political scrutiny and internal dissent. Other regressors, with the exception of the constant term, are also not significant. Thus, while in theory we can imagine that an increase in oversight can lead policymakers to self-censor to limit political repercussions,

[48] A similar strategy is used by Hansen, McMahon, and Prat (2018).

[49] Given that the measure of dissent is binary, models reported in Columns (1) and (2) are estimated using logistic regression.

in practice I find little evidence in support of this mechanism. As seen, this is in line with the results described in Table 2.3 above, which detect no change in the complexity of the transcripts in response to variations in political oversight.

Table 2.4: Political oversight and dissent

	Diss. votes (binary)		No. of interjections (average)		Cosine similarity ($\overline{Sim}$)	
	Logistic		*OLS*		*OLS*	
	(1)	(2)	(3)	(4)	(5)	(6)
News	0.039	0.086	0.290	1.036	0.003	0.007
	(0.117)	(0.113)	(1.219)	(1.239)	(0.011)	(0.011)
DistHearing	−0.105	−0.254	−2.076	−3.132	−0.017	−0.024
	(0.370)	(0.355)	(2.312)	(2.526)	(0.029)	(0.030)
News × DistHearing	−0.006	−0.024	0.146	−0.032	0.0001	−0.001
	(0.046)	(0.048)	(0.399)	(0.376)	(0.004)	(0.004)
NBER recession (binary)		−0.235		−1.240		0.011
		(0.183)		(1.535)		(0.015)
Lagged Dep. Var.	−0.555	−0.332	1.719	−2.672	−0.008	−0.050
	(0.436)	(0.415)	(3.446)	(3.628)	(0.047)	(0.046)
FOMC Chair (binary)	Yes	Yes	Yes	Yes	Yes	Yes
Post-November 1993 (binary)		Yes		Yes		Yes
Post-December 2004 (binary)		Yes		Yes		Yes
Greenbook forecasts (1 and 2-quarters ahead)		Yes		Yes		Yes
Year (factor)	Yes	Yes	Yes	Yes	Yes	Yes
Month (factor)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	176	176	185	185	185	185
R^2			0.565	0.621	0.543	0.611
Adjusted R^2			0.448	0.492	0.421	0.478
Log Likelihood	−85.441	−75.564				
Akaike Inf. Crit.	250.882	247.127				

Note: *p<0.1; **p<0.05; ***p<0.01

The table shows OLS estimates for different measure of internal dissent in FOMC's meetings. Columns (1)-(2) report results for logistic regressions using a binary measure for the occurrence of dissenting votes. Constant term included but not shown. Macroeconomic news coverage taken from BBD. Robust standard errors shown in parentheses.

Overall, while political attention induces greater disclosures in the committee's minutes, this effect is does not appear to be accompanied by variations in the decision-making process internal to the FOMC. Specifically, I find little evidence of a decrease in disagreement within the FOMC in moments of higher political scrutiny.[50] At least in

[50]This finding runs against the idea of a tradeoff between political visibility and efficiency in principal-agent relationship (Stasavage 2004; Meade and Stasavage 2008). Of course, the findings do not exclude

the case of the FOMC, therefore, policymakers appear to actively use communication as a way to manage legislative pressures. Taken together, these results reinforce the initial findings concerning a positive effect of political scrutiny on bureaucracies' disclosures, suggesting that oversight is an effective tool to enhance their political accountability.

2.9 Other robustness tests

Results for various additional robustness checks are reported in the Appendix. First of all, I assess the robustness of the findings to variations in the time window used to measure public salience, using again cosine similarity as a proxy for transparency. For this, I compare the estimated effect of average newspaper coverage computed on the three days before a meeting with that of the same variable calculated five days and five- to ten days before a meeting. The logic of these tests is that, if the committee actually responds to variations in the salience of its decisions, we should see smaller effects of newspaper coverage of macroeconomic issues away from the meetings. As shown in Appendix 2.C.1, coefficients on the interaction term –as well as on the individual coefficient for salience– get progressively smaller and less significant when the alternative time windows are used in the analysis. This suggests that the committee is specifically reacting to macroeconomic uncertainty close to a meeting, which reassures about the use of this indicator as proxy for the political visibility of the committee at specific points in time.

Secondly, I investigate the robustness of the main empirical findings to model specification. I start from repeating the main regressions using the beta model estimator proposed by Cribari-Neto and Zeileis (2009), which explicitly assumes the dependent variable to be limited between 0 and 1; as explained by the authors, this model allows to directly take into account potential heteroskedasticity problems related to the use of proportions in linear regressions. In addition, I re-run the main models after logging the dependent variable; this transformation limits the effect of outlying observations in the dependent variable on the results. As shown in Appendix 2.C.2, in both cases estimates are qualitatively equivalent to those obtained above, which eases concerns that the results are driven by model specification.

that in other context an increase in visibility of the decision-making process might induce a loss of information revealed by individual policymakers, particularly induced by a externally-enforced disclosure requirements (Hansen, McMahon, and Prat 2018). They do suggest, however, that –at least in the case of the FOMC– day to day mechanisms of oversight like hearings do not adversely impact the ability of bureaucracies to conduct policy.

Building on this, I take into account additional covariates. I replicate the results adding a binary variable taking the value of 1 after January 1993 (when the FOMC first changed the name and structure of the minutes), as well as dummy variables for FOMC Secretaries (Acosta 2015). I also add current-quarter Greenbook estimates for GDP, inflation and unemployment as controls, as well as values for core CPI, fixed investments, and government consumption. As shown in Appendix 2.C.3, coefficients on the main interaction term remain significant and very similar to the ones reported in Table 2.1 above, confirming the validity of the empirical approach. In particular, introducing binary variables for FOMC Secretaries does not affect overall results; this confirms that the content of the minutes constitutes the result of the committee's collective efforts rather than reflecting exclusively the Secretariat's choices.

In addition, I experiment with different time effects. First, I include a factor variable for the various days of the week in which meetings have taken place, which adds to pre-existing indicators for months and years. Second, I include a smooth time trend obtained fitting a spline regression to the cosine similarity indicator of disclosure: in addition to the time dummies, this variables captures smooth changes in communication policy over time which can be used to account for unobserved determinants of communication over time.[51] As shown in Appendix 2.C.4, results are robust to the use of these alternative time indicators, which suggests the main findings are not driven by unobserved unobserved dynamics in communication policy.

Similarly, results do not appear to depend on the sample period used for the analysis. To investigate this point, I repeat the the analysis using two alternative time windows: first, I extend the observation period to the early 1985, as a way to capture the last part of Volcker's tenure as Fed Chairman. Then, I limit the sample size to observations prior to failure of Lehman Brother on 15 September 2008; this helps accounting for the effects of the financial crisis on communication policy, particularly with respect to the use of transparency to manage economic expectations in an environment of low policy rates (e.g., Yellen 2013; Wynne 2013). As illustrated in Appendix 2.C.5, also in this case results are qualitatively analogous to those discussed above. In all cases, the idea of a positive relationship between political scrutiny and the transparency of the FOMC finds support in the data.

[51] For example, as a result of growing recognition of the role of transparency in monetary policy (Blinder, Ehrmann, et al. 2008).

2.10 Conclusions

In this paper, I have examined the ways in which the disclosures of public sector agencies respond to drivers of legislative oversight. Though little studied in existing literature, such organisations' announcements represent a key aspect of their public accountability. I have suggested that, rather than simply reflecting legal requirements imposed by the legislature, organisations actively adjust their disclosures in response to variations in oversight. The empirical analysis of the communication behaviour of the FOMC strongly supports this view.

From a policy perspective, the study has several implications for the analysis of communication and transparency within central banks. While existing contributions in economics have largely focused on the impact of announcements on policy transmission (e.g., Blinder, Ehrmann, et al. 2008), this is arguably the first study to highlight a political accountability rationale in monetary communication. In addition, the empirical results suggest that political supervision is not necessarily associated with changes in the decision-making process internal to monetary committees. At least in the case of the FOMC, legislative oversight appears to promote transparency without adversely affecting the ability of public organisations to conduct policy; this finding is arguably relevant for current debates about the role of transparency and supervision in the institutional design of central banks (e.g., Meade and Stasavage 2008; Hansen, McMahon, and Prat 2018). An additional finding is that communication, together with structures of political oversight, constitutes a useful way to promote the accountability and reputation of monetary committees. These issues have likely become even more important after the progressive adoption of financial stability tasks within central banks. Because these policies have potentially stronger redistributive implications than interest rate decisions, they are also likely to attract additional oversight efforts (e.g., Bean et al. 2010; Bean 2018). The study suggests that, in such circumstances, transparency constitutes a way in which monetary authorities can clarify the rationale underlying their decisions and manage political pressures.

The empirical findings have also implications for the study of bureaucratic delegation beyond monetary committees. As mentioned in the introduction to the paper, most existing contributions have focused on the formal rules that legislature and other political principals can impose on executive agencies to ensure timely transmission of information about policies (McCubbins, Noll, and Weingast 1987; 1989; Gailmard and

Patty 2012). By studying how agencies can use communication to protect their autonomy, instead, the study turns this logic on its head. I suggest that, when agencies face the risk of political sanctions, increasing the amount of information released can be convenient to protect their autonomy. A policy implication is that, by engaging with politicians about the rationale underlying policy decisions, agencies can manage political risk more effectively. In this respect, the study suggests that communication between public organisations and politicians can emerge endogenously as a way to promote policymakers' reputation. This finding is arguably relevant for the study of legislative control of the bureaucracy (e.g., Huber and McCarty 2004; Selin 2015) and the ways in which delegated agencies manage day-to-day interactions with political authorities (Potter 2017; Lowande 2019). Future research could investigate how these results extend to oversight and transparency in different policy domains.

Appendix

2.A Omitted proofs

Proof of Proposition 1

The proof proceeds by, first, considering the behaviour of the legislator. I then derive the best response for the agency. Finally, I characterise the agency's communication behaviour. In the following analysis, I initially consider the case in which $\omega = 1$.

The following lemma gives the best response for the politician.

Lemma 1. *The politician sanctions the agency after observing a wrong decision, and whenever communication fails.*

Proof. If communication is successful, P observes both action a and its consequence u. After observing a negative outcome $(u = 0)$ P's posterior is given by:

$$\pi(h|a = 0, \omega = 1) = \frac{0.5 \cdot \lambda \cdot (1 - q_h)}{0.5 \cdot \lambda \cdot (1 - q_h) + 0.5 \cdot (1 - \lambda) \cdot (1 - q_l)} = 0 \tag{2.12}$$

This follows from the assumption of a perfectly correlated signal for a high competence type of agency $(q_h = 1)$. After observing a negative outcome $(u = 0)$:

$$\pi(h|a = 1, \omega = 1) = \frac{0.5 \cdot \lambda \cdot q_h}{0.5 \cdot \lambda \cdot q_h + 0.5 \cdot (1 - \lambda) \cdot q_l} > 0.5. \tag{2.13}$$

The inequality (2.13) holds when $\lambda > q_l/(1 + q_l)$ (cf. Assumption 2.3 in Section 2.2).

The politician opts for a sanction τ when its expected payoff exceeds that of uphold-

ing the autonomy of the agency (action n):

$$\begin{gathered} E[U_P(\tau)] \geq E[U_P(n)] \\ \Rightarrow Pr(j = h|u)(u - r) + (1 - Pr(j = h|u))(u + r) \geq u \\ Pr(j = h|u) \leq 0.5. \end{gathered} \tag{2.14}$$

Given Assumption 2.3 on the prior, this is true when P observes a negative outcome $u = 0$ or when communication does not succeed (as $\lambda < 0.5$). ■

Next, consider the behaviour of the agency. Under the posited strategy, the bureaucracy sets the policy to be equal to the signal, $a = s_j$. The following lemma shows that this action is part of the agency's best response:

Lemma 2. *The agency sets* $a = s_j$.

Proof. Given the behaviour of the legislator (Lemma 1), conditional on communication the agency obtains a payoff u if the decision is correct and incurs a loss $-k$ if the decision is incorrect. The action $a = s_j$ is thus supported in equilibrium if:

$$\begin{gathered} E[U_j(a_j = s_j)] \geq E[U_j(a_j \neq s_j)] \\ \Rightarrow q_j(u) + (1 - q_j)(-k) \geq q_j(-k) + (1 - q_j)(u) \\ q_j \geq 0.5, \end{gathered} \tag{2.15}$$

true by assumption. ■

Lemma 1 and Lemma 2 yield parts (a) and (b) of Proposition 1. For part (c), assume that a pooling equilibrium exists. If the agency exerts a positive communication effort $y_j > 0$, it receives the status quo payoff u if communication is successful (with probability $y_j x$) and the decision is correct (with probability q_j). It incurs a loss $-k$ if the policy is incorrect (with probability $1-q_j$), and if communication fails (with probability $1 - y_j x$). This leads to the following expected utility from $y_j > 0$:

$$\begin{gathered} E[U_j(a, k, y_j > 0)] = \\ y_j x \Big[q_j(u) + (1 - q_j)(-k)) \Big] + (1 - y_j x) \Big[q_j(u - k) + (1 - q_j)(-k) \Big] - c(y_j) = \\ = y_j x q_j k + q_j u - k - c(y_j) \end{gathered} \tag{2.16}$$

Taking the first derivative with respect to communication efforts, we obtain the following first-order condition:

$$\begin{aligned} \frac{\partial EU_j(a,k,y_j>0)}{\partial y_j} &= xkq_j - c'(y_j) = 0 \\ &\Leftrightarrow c'(y_j^*) = xq_jk. \end{aligned} \tag{2.17}$$

Using (2.17), we also have that:

$$\frac{\partial^2 EU_j(a,k,y_j>0)}{\partial^2 y_j} = -c''(y_j^*) < 0 \tag{2.18}$$

given assumptions on the cost functions. This proves that y^* constitutes the unique value for $y_j \in [0,1]$ at which the utility from the communication is maximum; hence, if it exerts communication efforts, the agency opts for y^*.

For this to be part of an equilibrium, it is necessary that the expected payoff from action y^* exceeds the expected payoff obtained in the case of no communication, when $y = 0$. Using (2.16), this condition can be stated as:

$$\begin{aligned} EU_j(a,k,y^*) &\geq EU_j(a,k,y_j>0) \\ &= (y_j^*x)kq_j + q_ju - k - c(y_j^*) \geq q_ju - k \\ &\Rightarrow (y_j^*x)q_jk - c(y_j^*) \geq 0 \end{aligned} \tag{2.19}$$

Consider the function $g(y_j^*) = (y_j^*x)kq_j - c(y_j^*)$. By assumption, $g(0) = 0$ and $g(1) = xkq_j - c(1) < 0$. It follows that the condition expressed in (2.19) is satisfied if $g'(0) > 0$. Recall that $c(0) = 0$; hence $g'(0) = xkq_j > 0$. This proves that the agency's expected utility is higher choosing y^* than $y = 0$, so the strategy considered constitutes an equilibrium.

The reasoning is analogous in the case in which $\omega = 0$. ■

Proof of Proposition 2

Using (2.17), define $h(y_j^*) \equiv xkq_j - c'(y_j^*)$. We have that

$$\frac{\partial h(y_j^*)}{\partial y_j} = -c''(y_j^*) < 0$$
$$\frac{\partial h(y_j^*)}{\partial x} = kq_j. \tag{2.20}$$

By the Implicit Function Theorem, it follows that

$$\frac{\partial y^*(x)}{\partial y_j} = \frac{\frac{\partial h(y_j^*)}{\partial x}}{\frac{\partial h(y_j^*)}{\partial y_j}} = -\frac{kq}{-c''(y_j^*)} > 0, \tag{2.21}$$

which confirms the agency increases the level of disclosure y_j^* in response to an increase in attention. ■

2.B Extension: Politician observes outcome with probability p

I now consider the case in which the politician can observe the outcome of the agency's decision with probability p. For the following explanation, assume again that the underlying state is $\omega = 1$.

After observing a positive outcome $u = 1$, but without observing the decision itself, the politician has the following posterior belief concerning the probability of facing a high competence agency (Prat 2005):

$$\pi(h|u=1) = \frac{\lambda[0.5 \cdot (q_h) + 0.5 \cdot (1-q_h)]}{\lambda[0.5 \cdot (q_h) + 0.5 \cdot (1-q_h)] + (1-\lambda)[0.5 \cdot (q_l) + 0.5 \cdot (1-q_l)]}$$

Applying the reasoning in Appendix 2.A, the expected utility for the agency from ${y^*}_j > 0$ is now equivalent to:

$$\begin{aligned} EU_j(a,k,y_j>0) &= (y_j x)\Big[q_j(u) + (1-q_j)(-k)\Big] + \\ &+ (1-y_j x)\Big\{p[q_j(u) + (1-q_j)(-k)] + (1-p)[q_j(u-k) + (1-q_j)(-k)]\Big\} - c(y_j) = \\ &= (y_j x)(1-p)kq_j - pkq_j + uq_j - k - c(y_j) \end{aligned} \tag{2.22}$$

Taking first derivative of equation (2.22) and equating to zero, the communication effort in equilibrium is given by:

$$c'(y_j^*) = xk(1-p)q_j$$

The condition for equilibrium becomes:

$$(y_j^* x)k(1-p)q_j - c(y_j^*) \geq 0, \tag{2.23}$$

to which it is possible to apply the same reasoning considered for equation (2.19) above. The pooling strategy is still an equilibrium, as long as $p < 1$, although the communication effort is lower than in the case presented in the main text. Intuitively, if the politician can observe the consequence of the agency's decision even without communication, there is less incentive for the bureaucracy to increase efforts to explain the policy.

By applying the implicit function theorem to condition (2.23), it can also be seen that equilibrium communication efforts are always decreasing in p.

2.C Further robustness tests

2.C.1 Alternative measures of oversight

Table 2.C.1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
News	0.062***	0.055***			0.028*	0.018		
	(0.013)	(0.011)			(0.016)	(0.014)		
News (five days ahead)			0.060					
News (five- to ten days ahead)				0.022				
DistHearing	0.088***	0.130	0.111***	0.096***				
			(0.034)	(0.037)				
Hearings (frequency/month)					−0.105	−0.115	−0.093	−0.089*
							(0.071)	(0.048)
News × DistHearing	−0.013	−0.015						
News (five days ahead) × DistHearing			−0.011					
News (five- to ten ahead) × DistHearing				−0.006				
News × Hearings (frequency/month)					0.022**	0.025**		
News (five days ahead) × Hearings (frequency/month)							0.021**	
							(0.015)	
News (five-to ten days ahead) × Hearings (frequency/month)								0.021**
								(0.010)
Dissenting votes (binary)	0.019	0.022**	0.022**	0.023**	0.019*	0.022**	0.021**	0.022**
	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.010)	(0.011)
NBER recession (binary)		0.017	0.011	0.015		0.021**	0.021	0.030
		(0.011)		(0.011)		(0.011)	(0.020)	(0.020)
Lagged Dep. Var.	−0.006	0.027	−0.015	0.002	0.0001	0.023	0.021	0.042
	(0.087)	(0.094)	(0.086)	(0.093)	(0.087)	(0.094)	(0.081)	(0.082)
FOMC Chair (binary)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post-November 1993 (binary)		Yes	Yes	Yes		Yes	Yes	Yes
Post-December 2004 (binary)		Yes	Yes	Yes		Yes	Yes	Yes
Greenbook forecasts (1 and 2-quarters ahead)		Yes	Yes	Yes		Yes	Yes	Yes
Year (factor)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month (factor)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	176	176	176	176	176	176	176	176
R^2	0.864	0.878	0.885	0.878	0.863	0.876	0.876	0.872
Adjusted R^2	0.823	0.832	0.841	0.830	0.823	0.829	0.829	0.823

Note: *p<0.1; **p<0.05; ***p<0.01

2.C.2 Alternative estimators

Table 2.C.2

	Dependent variable:			
	Cosine similarity		Cosine similarity (logged)	
	Beta regression		*OLS*	
	(1)	(2)	(3)	(4)
News	0.345***	0.326***	0.221***	0.209***
	(0.083)	(0.080)	(0.068)	(0.067)
DistHearing	0.501**	0.865***	0.326*	0.464**
	(0.242)	(0.246)	(0.189)	(0.197)
News × DistHearing	−0.073**	−0.097***	−0.066**	−0.069**
	(0.035)	(0.034)	(0.027)	(0.027)
Dissenting votes (binary)	0.123***	0.138***	0.029	0.036
	(0.047)	(0.046)	(0.037)	(0.039)
NBER recession (binary)	0.089	0.072	0.088	0.081
	(0.091)	(0.092)	(0.071)	(0.074)
Lagged Dep. Var.		0.125	0.075	0.162
		(0.325)	(0.289)	(0.301)
FOMC Chair (binary)	Yes	Yes	Yes	Yes
Post-November 1993 (binary)		Yes		Yes
Post-December 2004 (binary)		Yes		Yes
Greenbook forecasts (1 and 2-quarters ahead)		Yes		Yes
Year (factor)	Yes	Yes	Yes	Yes
Month (factor)	Yes	Yes	Yes	Yes
Observations	176	176	176	176
R^2	0.926	0.931	0.946	0.950
Adjusted R^2			0.929	0.931
Log Likelihood	327.721	339.206		

Note: *p<0.1; **p<0.05; ***p<0.01

2.C.3 Alternative controls

Table 2.C.3

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
News	0.061***	0.062***	0.062***	0.063***	0.062***	0.054***	0.054***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.016)	(0.016)
DistHearing	0.093***	0.085**	0.085**	0.085**	0.094***	0.114***	0.114***
	(0.033)	(0.035)	(0.035)	(0.035)	(0.033)	(0.034)	(0.034)
News × DistHearing	−0.014	−0.013**	−0.013**	−0.013**	−0.014***	−0.013**	−0.013**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Dissenting votes (binary)	0.025**	0.020*	0.020*	0.020*	0.025**	0.023**	0.023**
	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)
NBER recession (binary)	0.005	0.017	0.017	0.017	0.006	0.023**	0.023**
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Lagged Dep. Var.	−0.014**	−0.020	−0.019	−0.021	−0.017	0.005	0.005
	(0.080)	(0.091)	(0.091)	(0.091)	(0.082)	(0.099)	(0.099)
Current quarter Greenbook forecasts	Yes				Yes		
Core inflation Greenbook forecasts (current quarter)		Yes			Yes		
Fixed investments Greenbook forecasts (current quarter)			Yes		Yes		
Government consumption Greenbook forecasts (current quarter)				Yes	Yes		
Secretary (factor)						Yes	
Minutes, new format (binary)							Yes
FOMC Chair (binary)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post-November 1993 (binary)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post-December 2004 (binary)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (factor)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month (factor)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	176	176	176	176	176	176	176
R^2	0.875	0.867	0.867	0.867	0.876	0.887	0.887
Adjusted R^2	0.832	0.824	0.824	0.824	0.829	0.840	0.840

Note: *p<0.1; **p<0.05; ***p<0.01

2.C.4 Alternative time effects

Table 2.C.4

	(1)	(2)	(3)
News	0.053***	0.056***	0.051***
	(0.015)	(0.017)	(0.015)
DistHearing	0.120***	0.150***	0.140***
	(0.034)	(0.039)	(0.035)
News × DistHearing	−0.012	−0.015**	−0.012**
	(0.005)	(0.006)	(0.005)
NBER recession (binary)	0.011	0.023**	0.017
	(0.011)	(0.011)	(0.011)
Lagged Dep. Var	−0.012**	0.040	0.006
	(0.092)	(0.095)	(0.093)
Flexible time trend (spline)	Yes		Yes
Day (factor)		Yes	Yes
FOMC Chair (binary)	Yes	Yes	Yes
Post-November 1993 (binary)	Yes	Yes	Yes
Post-December 2004 (binary)	Yes	Yes	Yes
Greenbook forecasts (1 and 2-quarters ahead)	Yes	Yes	Yes
Year (factor)	Yes	Yes	Yes
Month (factor)	Yes	Yes	Yes
Observations	176	176	176
R^2	0.884	0.881	0.887
Adjusted R^2	0.839	0.832	0.840
Note:			*p<0.1; **p<0.05; ***p<0.01

2.C.5 Alternative sample period

Table 2.C.5

	From 1 Jan. 1985		*Up to 15 Sep. 2008*	
	(1)	(2)	(3)	(4)
News	0.058***	0.054***	0.052***	0.046***
	(0.017)	(0.015)	(0.016)	(0.014)
DistHearing	0.074**	0.098***	0.082***	0.103***
	(0.031)	(0.034)	(0.027)	(0.034)
News × DistHear	−0.013**	−0.014***	−0.010*	−0.010**
	(0.005)	(0.005)	(0.005)	(0.005)
NBER recession (binary)	0.018	0.019*	0.009	0.013
	(0.013)	(0.011)	(0.014)	(0.013)
Lagged. Dep. Var	−0.017	0.019	−0.011	0.036
	(0.081)	(0.088)	(0.081)	(0.084)
FOMC Chair (binary)	Yes	Yes	Yes	Yes
Post-November 1993 (binary)		Yes		Yes
Post-December 2004 (binary)		Yes		Yes
Greenbook forecasts (1 and 2-quarters ahead)		Yes		Yes
Year (factor)	Yes	Yes	Yes	Yes
Month (factor)	Yes	Yes	Yes	Yes
Observations	198	198	180	180
R^2	0.870	0.883	0.865	0.879
Adjusted R^2	0.832	0.842	0.823	0.834

Note: *p<0.1; **p<0.05; ***p<0.01

Chapter 3

Themes and topics in parliamentary oversight hearings: A new direction in textual data analysis[1]

We pursue two broad goals in this paper. First, we seek to better understand the form and quality of deliberation in UK parliamentary select committee hearings on economic policy oversight. Inasmuch as these hearings are a key venue for public accountability, they entail a reciprocal dialogue between parliamentarians and both central bankers and Treasury ministers. The latter are under a statutory obligation to provide explanations for objectives held and decisions taken, and in this context, the central purpose of the hearings is deliberation. Notably, this "discussion phase" of accountability has received very little empirical investigation (Brandsma and Schillemans 2012), with even less given to the actual verbatim content of these hearings. By gauging the content of these hearings, this paper further contributes to the growing empirical work on deliberation by focusing on oversight of monetary policy, financial stability and fiscal policy in both the upper and lower houses of Parliament. Whereas the Treasury Select Committee (TSC) in the House of Commons has sole statutory authority to scrutinise both the Bank of England and the Treasury, the Lords Economic Affairs Committee (EAC) also exercises

[1]This paper was co-authored with Cheryl Schonhardt-Bailey and James Sanders. The study is published with the same title on *Statistics, Politics and Policy*, 8(2), April 2018.

its own power to hold hearings with these two groups. Hence, studying deliberation in both the TSC and the EAC allows us to vary the deliberative setting to include (1) an elected body (the TSC) questioning both unelected officials from the Bank and elected ministers from the Treasury; and (2) an unelected body (the EAC) similarly questioning both unelected and elected witnesses.

These variations in the deliberative setting enable our investigation of two distinct indicators of deliberative quality in oversight hearings: (1) reciprocal dialogue, and (2) non- (or cross-) partisanship, which we explain in our next section. In brief, we assert that effective discussion in oversight hearings should exhibit dialogue in which committee members ask policy-relevant questions, and witnesses provide answers to these same questions (i.e., their responses are not diversionary). Moreover, to be effective, the exchanges should re- late to policy processes and outcomes, rather than exhibit overt partisanship or political point-scoring. The approach taken here is broadly exploratory, but our two indicators of deliberative quality in oversight hearings provide the basis upon which we assess the content of these hearings.

Reliance on textual analysis software is not without its pitfalls, as some have noted (Grimmer and Stewart 2013). As our second broad goal, we bring together two approaches to automated content analysis – thematic and topic modelling – which previously had little in common (Grimmer and Stewart 2013, Illia, Sonpar, and Bauer 2014). We demonstrate that while these approaches have different assumptions, algorithms and forms of output, there is nonetheless a common foundation upon which to deepen our understanding of the text under investigation, and using this foundation, there is opportunity to expand the toolkit for automated textual analysis. In short, we argue that by conducting multiple automated content analyses on the same corpus we offer a more comprehensive empirical examination of both aspects of quality of deliberation in oversight hearings (i.e., reciprocity and non-partisanship). Moreover, in this process, we outline more clearly the commonalities and differences between "themes" and "topics" in political texts.

3.1 Measuring Deliberation in Parliament

While the conceptual underpinnings of accountability vary, there is broad agreement that at its core, accountability "involves an obligation to explain and justify one's past conduct" (Brandsma and Schillemans 2012, pg. 966), and critical to this is a discus-

sion phase in which questions may be raised and actors are given the opportunity to provide reasons for their decisions and policy actions. Whereas existing quantitative assessments of accountability do not generally focus on this discussion stage (Brandsma and Schillemans 2012, pg. 957), scholars of deliberative democracy offer a foundation for studying deliberative discourse (Bachtiger, Neblo, et al. 2010), with its focus on reasoned argument. Measuring empirically the existence, the extent and the quality of such reasoned argument in real world settings nonetheless remains a formidable task. Recent studies have sought to gain traction on the empirics of deliberation by isolating and then measuring one or two critical dimensions (e.g., "information" (Mucciaroni and Quirk 2006); or "open-mindedness" (Barabas 2004)). We adopt this same stance on deliberation, but with the intent being to measure what is arguably the core feature of monetary and fiscal policy accountability –that is, the provision of explanations for objectives held and decisions taken. Specifically, legislators are expected to challenge Bank and Treasury officials and ministers on their policy decisions and these individuals are, in turn, expected to provide reasons for their decisions. Effective deliberation between politicians and both unelected officials and elected ministers who are being held to account is thus one of engagement and reciprocity (i.e., participants talk to one another and take up others' points).

Previous empirical studies of deliberation in legislatures have typically analysed floor debates, with legislators deliberating the merits of legislation (Steiner et al. 2004, Quirk and Binder 2005, Mucciaroni and Quirk 2006, Bachtiger and Hangartner 2010). In contrast, in this paper (a) the focus is on the varying dialogues between elected legislators and unelected officials and elected ministers; (b) the deliberation itself occurs in committees; and (c) the purpose is to hold both the Bank of England and the Treasury to account, thereby providing a link between economic policy decision making and the will of the voting public. This study thus constitutes a specific type of legislative deliberation. The approach here is also novel in that it does not examine the ex-ante controls that legislators might seek to devise over agencies (i.e., as in principal agent theories (Bawn 1995, Huber and Shipan 2000, 2002), but rather focuses on economic policy hearings. These hearings are an ex-post form of oversight and as such are less well understood by political scientists (McGrath 2013, pg. 349), or when examined, are done so in terms of the number of hearings rather than their substantive content (Feinstein 2014). This study focuses on a specific form of deliberation in committees with legislators and witnesses from both the central bank and Treasury, where the account-

ability of the latter requires a critical and robust exchange of views between the two sets of participants. And, to be effective, the reciprocal dialogue must entail a critical review across all relevant issues of the decisions of the witnesses giving testimony.

Our second empirical indicator of effective deliberation in oversight hearings is that exchanges between questioners and witnesses should relate to policy processes and outcomes, rather than exhibit overt partisanship or political point-scoring. Importantly, parliamentary reforms in 2010 stripped power away from party whips to appoint select committee members and instead created elections for both members and committee chairs, which then gave committees more autonomy to hold Government to account (UK Parliament 2013). These reforms have further embedded the expectation that select committees should endeavour to conduct scrutiny in a nonpartisan manner – that is, they "might exercise their parliamentary, rather than party, muscles by engaging in scrutiny activity geared towards better holding government to account"' (Keslo 2012, pg. 5). Indeed, Andrew Tyrie, Chairman of the TSC, argues in his 2015 book that "Select Committees are now much more effective scrutineers and investigators than they were even five years ago" (Tyrie 2015, pg. 34), but can this more effective oversight be said to apply across all policy areas, particularly in terms of fostering the nonpartisan ethos? This study addresses this question by examining the verbatim transcripts from the hearings of the Treasury Committee and the hearings of the Economic Affairs Committee on monetary policy, financial stability and fiscal policy, for the whole of the 2010-15 Conservative-Liberal Democrat Coalition Government. Textual analysis software is employed to analyse these data in their entirety.

3.2 Select Committees

3.2.1 Treasury Select Committee and Economic Affairs Committee

Elsewhere the broader context for the study of UK Select Committee hearings is discussed in depth (Schonhardt-Bailey 2015). Nonetheless some brief context is required for the hearings on economic policy oversight by both the Commons' Treasury Select Committee and the Lords' Economic Affairs Committee for the 2010-15 Parliament.

The Treasury Select Committee (TSC) is responsible for overseeing the spending, policies and administration of both the Treasury and the Bank of England. Scrutiny of the Treasury is most conspicuous in the form of an inquiry into the Budget statement.

Following each spring's Budget statement, the committee gathers evidence from witnesses (including the Chancellor of the Exchequer) on the Government's proposals, and then publishes its recommendations and conclusions. In turn, the Government responds to the committee's findings, often incorporating information from the Office for Budget Responsibility.

Similar to other independent central banks, the Bank of England is subject to formal legislative oversight. The objective of UK monetary policy is laid down in the 1998 Bank of England Act, where the stated priority is price stability and "subject to that", the legislation mandates the Bank to support the Government's policies for growth and employment. The Bank pursues an inflation target (currently 2%) which is set by the government. The Bank is independent with respect to the instruments chosen (usually by varying a short-term interest rate, but also by so-called quantitative easing via asset purchases) to achieve the objective of low inflation, without interference from political actors. The Bank's Monetary Policy Committee (MPC) is tasked with formulating monetary policy decisions. With respect to financial stability, financial services reforms of 2012/13 created the Bank's Financial Policy Committee (FPC), which has statutory responsibility for financial stability by lessening the scope for systemic risks and preventing the likelihood of future financial crises (or reducing their impact).

The Treasury Select Committee conducts hearings with representatives from the Bank's MPC[2] and FPC on their policy decisions. In contrast to fiscal policy, the Treasury committee does not produce a subsequent report following these monetary policy and financial stability oversight hearings.

Committees in the House of Lords operate quite differently from those in the House of Commons, and by all accounts, are less partisan in nature. Most importantly, Lords committees do not scrutinise government departments in the way that Commons committees do. Instead, Lords committees are more thematically constructed, focusing on four main areas –economics, Europe, science and the UK constitution. And, because individuals can become peers based on years of experience and excellence in their fields, committees in the upper house often exploit this experience and expertise in the composition of committee memberships. Whereas since 2010, members in Commons com-

[2] A rotation of members of the Monetary Policy Committee testify on the Inflation Report. The MPC consists of both internal and external members, with the former comprised of the Governor, two Deputy Governors, the Executive Director for Markets and the Chief Economist. There are four external members and apart from their position on the MPC these individuals hold no other position at the BoE. MPC members rotate before the TSC, but the delegation almost always includes the Governor.

mittees are elected by party groups and chairs are elected in a secret ballot by the whole chamber (as noted above), members of committees in the Lords are appointed by more traditional means –namely, via the whips. Furthermore, and in contrast with the Commons –crossbenchers in the Lords lessen the scope for partisan clashes, as does the absence of electoral motivations. Other features of the Lords committees include their reputation for investigating issues that are both "more strategic" and "more technical" –thereby reflecting the experience and expertise of their members (Russell 2013, pg. 210). In a recent comparison of Commons and Lords committees, Russell has described the latter as "less adversarial" in hearings with experts (Russell 2013, pg. 211).

The Economic Affairs Committee (EAC) is responsible for reviewing economic affairs – which, broadly defined, may range from tax avoidance to the economic ramifications of shale gas. The EAC conducts occasional hearings, some of which contribute to formal reports and others are meant as information gathering exercises. Of significance is that the EAC is a relatively new committee, growing from ad hoc status in 1998 (to monitor the new MPC, as the Blair-Brown Labour Government made the Bank independent) to permanency in 2001.

In sum, while both the Commons and Lords committees conduct hearing covering aspects of monetary policy, fiscal policy and financial stability, there are many important unique characteristics of each committee. As our focus is on deliberative quality in oversight hearings, we seek to assess these two committees according to our criteria of reciprocity and partisanship, by examining empirically the verbatim transcripts of these hearings.

3.3 Our Methodological Approach

We identify and explore two broad approaches to automated textual analysis, each with different assumptions as to the context in which words appear in a text. The first approach – which we call "thematic" (and elsewhere is referred to as keyword-in-context, or KWIC (Illia, Sonpar, and Bauer 2014)) – assumes that speakers of textual data convey meaning in a distinctly thematic fashion, so that it is not just the words that help to classify content but also the context in which the words appear. Thematic approaches to textual data are particularly effective in settings in which the form of argumentation or deliberation is of research interest, as it allows one to capture the sequencing, reciprocal and interactive nature of the argumentative structure. In the pre-processing stage, words

are reduced to their lemmas and aspects of the text such a punctuation are retained in order to identify how words appear together in a section of text. Software using this approach employs co-occurrence analysis to examine the bivariate associations between words and phrases in order to map out concept clouds (specifically, the existence of words and phrases that tend to co-occur), and the relationships between concept clouds within a single corpus. A common feature of these approaches is to cluster textual units according to their semantic similarity. Such classifications are normally achieved by finding a partition of classes that maximises variation in the vocabulary across the different groupings.[3] The interpretation of the clusters obtained proceeds by analysing the occurrences of particular terms in any given class. Besides this, thematic approaches also rely upon multiple spatial representations of the associations (correspondence analysis, dendrograms [or distance trees]) to capture relationships between themes in the corpus and independent variables which identify unique characteristics of the authors of the text (names, party affiliation, role, etc) and the setting (speech, hearing, date, place).

A second approach to automated content analysis is topic modelling. Topic models (Blei and Lafferty 2006, 2009) have been employed to capture the content of political texts (Grimmer 2010, Quinn et al. 2010), where the task is to automatically classify the contents of documents into "topics". These models do not conceptualise the text under investigation as inherently argumentative or deliberative –and particularly not in a way that would require a reciprocal and interactive mode of communication among the participants. Rather, these models conceptualise the textual data more as what Goodin (2000) describes as "notice posting" –that is, more as a one-way flow of communication. Instead of lemmatisation, applications of these models normally simplify the vocabulary by reducing words to a single root ("stemming") –where, for example, *institution*, *institutions*, *institutional* might all conform to *institution*. As one review of this approach notes (Grimmer and Stewart 2013, pg. 272), stemming is a "crude" but "faster" form of "lemmatisation", with the latter employing word and sentence context (including punctuation) and dictionaries for a richer, more nuanced mapping of the text. Unlike thematic analyses, topic models employ a probabilistic approach whereby topics represent joint probability distributions over documents and words.

We maintain that a thematic approach to analysing textual data is, prima facie, the preferred methodology for a study of deliberation. A thematic approach allows the researcher to capture and measure the sequencing of argument and moreover, how others

[3]The process followed by each specific software is explained in more detail below.

respond to the particular arguments made. Because deliberation requires reasoned argument, any approach that fails to capture how arguments develop and the extent to which others respond (or not) to a form of argumentation, is inherently missing the key component of deliberation. This is not to say, however, that an alternative approach like topic modelling is entirely inappropriate for studying deliberation. Topic models enable one to capture the underlying content of the deliberation, which is of fundamental importance. Indeed, knowing the content of the deliberation is a precursor to understanding how the arguments implicit within that content develop as a sequence over time and how others respond to the reasons given in these arguments. We therefore begin with a thematic approach by default, but then use topic modelling as a means to extend the analysis to lend new insights into our understanding of the content of the discourse and how that content varies over a set of covariates.

In both cases, our key task in examining the parliamentary oversight hearings is to ascertain the extent to which witnesses are effectively held to account. Do they answer the questions asked? Is the dialogue reciprocal or diversionary? Are parliamentarians more interested in making partisan jabs than in uncovering and understanding the reasons for decisions made and actions taken?

3.4 Data

As outlined above, the Treasury Select Committee holds regular hearings with MPC members on the Bank of England's Quarterly Inflation Report;[4] with FPC members of the Bank on the Financial Stability Report;[5] and with the Chancellor of the Exchequer on the government's budget. In contrast, the hearings of the Economic Affairs Committee are less frequent for both monetary and fiscal policy, and for the period of this study it held no hearings on the Financial Stability Report.[6] Appendix 3.A lists the hearings included for each committee for the 2010-15 Conservative-Liberal Democratic Government: in total, thirty for the TSC (sixteen on monetary policy, seven on financial stability, and seven on fiscal policy), and seven for the EAC (four for monetary and three

[4]The Bank of England publishes the Inflation Report quarterly (February, May, August and November). The Treasury Select Committee does not necessarily hold hearings on each of the reports.

[5]The Bank of England publishes the Financial Stability Report semi-annually (July, December). This study includes the hearings on these reports from their statutory origin in 2013.

[6]Financial Stability hearings began in the TSC with the "interim FPC" in 2012. Following the passage of financial services legislation in 2013, the Financial Stability Committee formally came into existence.

for fiscal policy). Further appendices in Schonhardt-Bailey (2015) provide details of the committee memberships and partisan affiliations, and a full list of witnesses who gave oral evidence in each committee hearing, along with the committee members appearing for each hearing.

The data are initially structured into five text files, comprised of the above hearings for each committee –that is, each committee's hearings on economic policy are separated into those covering monetary policy, financial stability and fiscal policy. The text files are structured so that each speech or remark constitutes a "case", and each is identified with identifying characteristics (or "tagged covariates") –the name of the speaker, his or her party affiliation (including "crossbenchers" for the Lords and "no party" for central bank officials and Treasury witnesses), the speaker's role (committee chair, committee member, MPC internal member, MPC external member, Chancellor, Treasury staff), and the date of the hearing. We analyse each of these independently using the software Alceste, forming thematic classes using the words contained only in a given hearing. We then compare the results obtained with those from an additional proprietary software, T-Lab, which we apply on an identical dataset. We add to the results from T-Lab and Alceste those derived from fitting a Structural Topic Model (STM), implemented using the *stm* package in R (M. E. Roberts et al. 2014) to a dataset which combines the five corpora into a single collection. In the remaining part of this section, we briefly outline the algorithm employed by each software, followed by a comparison of the classes and topics formed in each case.

3.5 Cluster Matching

The Treasury Select Committee (TSC) and the Economic Affairs Committee (EAC) hold hearings based on a variety of policy areas. As such, we can neatly segregate the data into five distinct corpora as follows: TSC Monetary Policy, TSC Financial Stability, TSC Fiscal Policy, EAC Monetary Policy, and EAC Fiscal Policy. In this section we analyse each of these independently using the software Alceste, forming classes using the words contained only in a given hearing. We then compare the results obtained with those from an additional thematic software, T-Lab, which we apply on an identical dataset. Finally, we compare results obtained with T-Lab and Alceste with those derived from fitting a Structural Topic Model (STM) to a dataset which combines the five corpora into a single collection.

The reason we compare the clusters formed by these three approaches is that if there were disagreements regarding the substantive content of these debates, we could not take full advantage of the unique tools available to us in each software because each would be considering disparate concepts –that is, we could not study reciprocity and partisanship on the same policy dimension if it only appeared in one set of results.

In the remaining part of this section, we briefly outline the algorithm employed by each software, followed by an explanation of the procedure used for the comparison of the classes and topics formed in each case.

3.5.1 Alceste

Alceste is a proprietary thematic analysis software, meaning it considers co-occurrences across lexical units (key words) to form stable classes that are representative of the text. The software proceeds by identifying a set of 'gauged sentences' (or Elementary Context Units, ECUs), from a pre-existing division of the text specified by the user (Schonhardt-Bailey 2005). This constitutes the sampling unit of the analysis. In our case, it is represented by single interventions in committees hearings.

Using the occurrence of words in each ECU, Alceste builds the classification using a iterative descending hierarchical classification algorithm which decomposes the classes until a predetermined number of iterations fails to result in further significant divisions (Reinert 1998). More specifically, it operates upon the corpus as follows:

1. Parsing of the vocabulary.

2. Transforming the corpus into a sequence of Elementary Context Units (ECUs) containing lemmas and operates a descending classification which produce stable classes of these ECUs, leaving what does not fit in these classes remain unclassified.

3. For each stable class, it operates a series of statistical characterisations, thereby forming a lexical world.

4. The lexical world is free to be interpreted by the operator.

Step 4 –class interpretation and labelling– is the most important for substantive interpretation. It requires the researcher to apply semantic meaning to a list of characteristic

lemmas and ECUs ordered by their ϕ and χ^2 values. This involves first looking at the list of the most representative words for each semantic class and, second, analysing the ECUs most strongly associated with each class. The labelling process is repeated for each class, until the user has assigned a label to all lists – after which, more complex analyses (i.e. dendrograms, correspondence analysis etc.) can begin. This process was applied to each of our five corpora individually. The results of the labelling process are displayed in Table 3.1.

Table 3.1: Alceste Class Labels

Corpus	Label
TSC MP	Bank of England Lending Facilities
TSC MP	Real Economy, Productivity & Competitiveness
TSC MP	Monetary Policy Decisions & Decision Making Process
TSC MP	Inflation Forecast & Outlook for Inflation
TSC MP	Forward Guidance & Outlook for Monetary Policy
TSC FP	Tax and Benefits
TSC FP	Budget Process and Role of Ministers
TSC FP	Budget Leaks
TSC FP	Economic Effects of Budget
TSC FP	Public Deficit and Debt
TSC FS	Bank Capital, Leverage & Lending Capacity
TSC FS	Housing & Household Indebtedness
TSC FS	Governance of the Bank of England
TSC FS	Barclays and LIBOR
EAC MP	Pensions, Savings & Annuities
EAC MP	Real Economy & Economic Forecasts
EAC MP	Financial Stability & Macro Prudential Policy
EAC MP	Banking & Bank Regulation
EAC MP	Too Big to Fail & Bank Resolution
EAC MP	Stress Testing Banks & Bank Lending
EAC FP	Energy, Energy Prices, Gas & Shale Oil
EAC FP	Real Economy & Bank Lending
EAC FP	Financial Services & Regulation
EAC FP	Scotland & Regions

3.5.2 T-Lab

Similar to Alceste, T-Lab employs a thematic approach to classification, considering co-occurrences between lexical units. As well as being algorithmically independent, T-Lab also offers more opportunities to tailor its methods to the particular research question and data. As such, this brief description of methods will also justify any methodological or algorithmic decisions.

To normalise the data before clustering, T-Lab utilises the tf-idf (Salton 1989) measure and the Euclidean norm. Then, the software can conduct a supervised (top-down) classification, unsupervised (bottom-up) classification or a mixture of both. We choose the latter by using an unsupervised classification method and then refining these results using a supervised method. The researcher is provided two variants for seeding the algorithms: bisecting K-means, or PDDP and K-means. The two methods vary by how the seeds of each bisection are calculated. A bisecting k-means analysis gains its seeds for each bisection through an iterative algorithm. In the PDDP (Principal Direction Divisive Partitioning) and K-means method, the seeds are computed through a Singular Value Decomposition (see Boley 1998). Once the seeds have been selected they are then used for each K-means bisection, much like the first method (Lancia 2017). As for deciding the most appropriate seeding to use, Savaresi and Boley (2004, p. 361) compared the two methods and concluded "the best compromise between computational effort and cluster quality is to use K-means initialised with the PDDP result". Hence, to obtain the best results with the computational resources available, in his thematic analysis we run an unsupervised clustering using the PDDP and K-means process.

Once the initial clusters have been calculated, T-Lab gives the option to refine the results of the obtained partition. The first variant is a Naive Bayes Classifier, which allows the analyst to remove from the analysis all context units that do not pass a given criteria. A second method to refine the partition is offered by a reclassification based on typical words, which performs a supervised classification by considering the characteristic lemmas as items of a category dictionary. This second method is more selective and hence tends to harbour a lower ECU classification rate. Despite this, we select this refining method because: (1) the loss of elementary contexts is only marginally greater than the alternative; and (2) it arguably offers a more precise and rigorous classification.

Once the partitions have been refined,[7] the researcher then assigns meaning to each

[7]T-Lab provides the researcher some freedom to specify the number of clusters formed during the

class in a similar way to that in section 3.5.1. The final labels are displayed in Table 3.2.

Table 3.2: T-Lab Class Labels

Corpus	Label
TSC MP	Outlook for inflation and Inflation Expectations
TSC MP	Bank Lending to SMEs
TSC MP	Scotland and Foreign Exchange Reserves
TSC MP	Real Economy and House Price Growth
TSC MP	Quantitative Easing Discussions
TSC FP	Housing Benefit
TSC FP	Fiscal Deficit and Government Debt
TSC FP	Ministerial/Cabinet Involvement in the Budget Process
TSC FP	Income Tax Rates
TSC FP	Bank Lending to SMEs
TSC FS	Bank Stress Tests, Mortgage Lending and House Prices
TSC FS	Bank of England Governance and FPC/MPC
TSC FS	LIBOR
TSC FS	Parliament and Govt Roles in respect of FPC/PRA
EAC MP	Inflation Outlook and the Economy
EAC MP	Bank Capital and Lending
EAC MP	Scottish Referendum
EAC MP	Leverage Ratio for Banks
EAC MP	QE and Pension Investment
EAC MP	Bank Policy Committee Decision Making
EAC FP	Tax Measures (Notably Energy)
EAC FP	Financial Crisis/International Debt Problems (especially Ireland)
EAC FP	EU/Financial Services/Regulation
EAC FP	Scotland

classification. To guarantee a simple and direct comparison with Alceste, we set the number of classes in the classification of each corpus to be the same as the number derived in Alceste.

3.5.3 Structural Topic Model

Our final method is the structural topic model (STM) recently proposed by Roberts, Stewart, Tingley et al. (2014). STM builds upon previous topic models, including the Latent Dirichlet Allocation (LDA) (Blei, Ng, and Jordan 2003) and Correlated Topic Model (CTM) (Blei and Lafferty 2007). Similar to LDA, the STM is a generative model of the text: its algorithm defines a data-generating process for each document and then word frequencies observed within documents are used to find the most likely values for the model parameters.

Topic models assume the text to be generated by a fixed number of topics K, each representing joint probability distributions over documents and words. A single topic is defined as a probability distribution over the vocabulary, where each word has a probability of belonging to a given topic. A document is itself a mixture of topics – that is, a single document can be composed of multiple different topics depending on its constituent words. More specifically, topical *content* refers to the probability that a given word from the vocabulary can be found within a document, whilst topical *prevalences* refer to the probability a particular document belongs to a topic. Topic content is used for identifying the hidden semantic structures within the documents, while topic prevalences are used for analysing the occurrence of a given semantic class within a particular document.

The key innovation of the STM is the inclusion of document level meta-data (covariates) into the analysis. In each case, each document (in our case each intervention in the hearing) is assigned a list of covariates (i.e. chamber, party, etc). This feature of the model, and related plotting functions in the *stm* package used to fit the algorithm, allows the user to examine the relationships between topics and document level covariates to gain a deeper understanding of the text. In particular, it allows the researcher to condition the analysis of topic prevalence across the set of covariates. We will refer to this particular feature of STM in a subsequent section.

As other topic models, STM requires the number of topics to be fixed in advance by the researcher. This normally involves a trade-off between model fitting and information provided (Grimmer and Stewart 2013), as K must be large enough to produce distinct semantic classes but small enough to be useful for the analysis (Quinn et al. 2010). Our selection method proceeds in two steps. First, we compare model performance by

analysing the held out likelihood values, a measure of model fit for topic models,[8] for STM fits with a number of topics ranging from 5 to 80. This procedure indicates that a K in the neighbourhood of 25-40 provides a reasonable fit of the data.[9] Second, we analyse the topical content of models in this particular range to understand which one provides the most interpretable results. By so doing, we select a model with $K = 30$ topics,[10] which we use for the analysis presented in the next section.

The resulting labels are reported in Table 3.3; these are obtained by analysing the topical content for each semantic class identified by the algorithm, a process which is analogous to that carried out for Alceste and T-Lab. Further details about model selection, in particular concerning the choice of the number of topics adopted, are described in Appendix 3.B.

[8]The held out likelihood indicates the extent to which a particular model, trained on a subset of words, can be used to predict the probability of the remaining terms. See Appendix 3.B for more explanations.

[9]See Appendix 3.B

[10]Results remain very similar changing slightly the number of topics.

Table 3.3: STM Topic Labels

Topic #	Label
1	Labour Market/Economic Growth
2	Bank Lending to SMEs
3	Policy Discussion/Form of Policy
4	LIBOR
5	Real Economy/Investment
6	Path of Expected Inflation
7	Housing Market/New Home Building
8	Quantitative Easing
9	Policy Discussion
10	FPC/Household Debt
11	Transmission of Policy to the Economy
12	European Union
13	Policy Discussion
14	Accountability to the TSC
15	Rebalancing of Debt and Imbalances
16	Borrowing Costs/Transmission of Monetary Policy
17	FPC/Bank Capital and Stress Tests
18	Policy Discussion
19	Eurozone/Global Risks to the UK
20	Scotland
21	Monetary & Fiscal Policy Mix
22	Policy Discussion
23	Bank of England Governance/Oversight Committee
24	Fiscal Outlook
25	(Reform of) Bank Regulation
26	(Reform of) Bank Capital
27	Fiscal Policy/Tax and Benefits
28	Public Spending Controls
29	MPC Process and Transparency
30	Financial Market Volatility

3.5.4 Matching Topics and Themes

To follow our aim of producing robust textual analysis results, we must compare outputs from these various methodologies. Using different software to analyse the same body of text requires the semantic classification produced by the software to be consistent across methods. A high proportion of matching topics and themes would imply that our results are representative of the substantive nature of committee discourse, thus indicating that it is possible to use specific features of each software to analyse the content of deliberation. However, a lower matching proportion would suggest that our outputs are more a result of model choice than input data, potentially undermining the validity of the results.

Matching labels may lead to inaccuracies caused by the sequential nature of labelling, leaving the results more prone to human biases/errors. At the same time, all three methods provide lists of characteristic words, and it is these that we compare when matching classes. While it would be possible to automate the process of matching these lists of characteristic words, we avoided doing so for two reasons. First, all unsupervised methods will – at some point – require subjective analysis of the output materials. Hence, automating the matching process will merely delay the necessary qualitative interpretation (see Grimmer and Stewart 2013). Second, the nature of the output varies widely by software, with T-Lab and Alceste including lists of the most characteristic ECUs. Interpretation and comparison of these plain text segments requires an understanding of the underlying nature of deliberative discourse and hence can be conducted more effectively by the researcher.

In most cases, the qualitative comparison of topics and thematic classes produced by the various software is intuitive. For example, representative words for class 2 in T-Lab and class 1 in Alceste include the terms *lend*, *small*, *bank*, *size*, and *enterprise*. These are analogous to words associated with Topic 2 (*bank*, *lend*, *small*, *fund*). In both cases, the semantic category produced by the program concerns bank lending to small and medium size enterprises. Similarly, class 2 in Alceste and class 4 in T-Lab include terms concerning growth and productivity (*growth*, *product*, *income*), which correspond to words clustered in Topic 1 (*growth*, *economy*, *product*). This semantic cluster relates to discussions about the real economy and productivity. For the cases in which a correspondence is not immediately clear from the list of characteristic words, we compare the representative ECUs produced in the Alceste detailed report with the

documents most closely associated with each cluster in both T-Lab and STM. We apply the same procedure for all thematic clusters and topics.

Appendix 3.D reports a detailed overview of the characteristic words used to derive each label and compare software output. Below we report the labels for classes which exhibit similar linguistic content across the different software. Specifically, Table 3.4 matches T-Lab classes to the Alceste output, and Table 3.5 matches STM topics to the Alceste output.

Table 3.4: Alceste Classes and their Matching T-Lab Classes

Corpus	Alceste Label	Matching T-Lab Class
TSC MP	Bank of England Lending Facilities	Bank Lending to SMEs
TSC MP	Real Economy, Productivity & Competitiveness	Real Economy and House Price Growth
TSC MP	Monetary Policy Decisions & Decision Making Process	Quantitative Easing Discussions
TSC MP	Inflation Forecast & Outlook for Inflation	Outlook for Inflation and Inflation Expectations
TSC MP	Forward Guidance & Outlook for Monetary Policy	-
TSC FP	Tax and Benefits	Income Tax Rates
TSC FP	Budget Process and Role of Ministers	Ministerial/Cabinet Involvement in the Budget Process
TSC FP	Budget Leaks	-
TSC FP	Economic Effects of Budget	Bank Lending to SMEs
TSC FP	Public Deficit and Debt	Fiscal Deficit and Government Debt
TSC FS	Bank Capital, Leverage & Lending Capacity	-
TSC FS	Housing & Household Indebtedness	Bank Stress Tests, Mortgage Lending and House Prices
TSC FS	Governance of the Bank of England	Bank of England Governance and FPC/MPC
TSC FS	Barclays and LIBOR	LIBOR
EAC MP	Pensions, Savings & Annuities	QE and Pension Investment
EAC MP	Real Economy & Economic Forecasts	Inflation Outlook and the Economy
EAC MP	Financial Stability & Macro Prudential Policy	Leverage Ratio for Banks
EAC MP	Banking & Bank Regulation	-
EAC MP	Too Big to Fail & Bank Resolution	Bank Capital and Lending
EAC MP	Stress Testing Banks & Bank Lending	-
EAC FP	Energy, Energy Prices, Gas & Shale Oil	Tax Measures (Notably Energy)
EAC FP	Real Economy & Bank Lending	-
EAC FP	Financial Services & Regulation	EU/Financial Services/Regulation
EAC FP	Scotland & Regions	Scotland

Note: The table matches the labels of the semantic classes produced by Alceste with T-Lab clusters which exhibit a similar linguistic content. Appendix 3.D reports a detailed overview of the characteristic words produced by the two software.

Table 3.5: Alceste Classes and their Matching STM Topics

Corpus	Alceste Label	Matching STM Topic
TSC MP	Bank of England Lending Facilities	(2) Bank Lending to SMEs
TSC MP	Real Economy, Productivity & Competitiveness	(1) Labour Market/Economic Growth
TSC MP	Monetary Policy Decisions & Decision Making Process	(29) MPC Process and Transparency
TSC MP	Inflation Forecast & Outlook for Inflation	(6) Path of Expected Inflation
TSC MP	Forward Guidance & Outlook for Monetary Policy	(6) Path of Expected Inflation
TSC FP	Tax and Benefits	(27) Fiscal Policy/Tax and Benefits
TSC FP	Budget Process and Role of Ministers	(4) LIBOR
TSC FP	Budget Leaks	(14) Accountability to the TSC
TSC FP	Economic Effects of Budget	(5) Real Economy/Investment
TSC FP	Public Deficit and Debt	(15) Rebalancing of Debt and Imbalances
TSC FS	Bank Capital, Leverage & Lending Capacity	(26) (Reform of) Bank Capital
TSC FS	Housing & Household Indebtedness	(7) Housing Market/New Home Building
TSC FS	Governance of the Bank of England	(23) Bank of England Governance/Oversight Committee
TSC FS	Barclays and LIBOR	(4) LIBOR
EAC MP	Pensions, Savings & Annuities	(11) Transmission of Policy to the Economy
EAC MP	Real Economy & Economic Forecasts	(6) Path of Expected Inflation
EAC MP	Financial Stability & Macro Prudential Policy	(10) FPC/Household Debt
EAC MP	Banking & Bank Regulation	(26) (Reform of) Bank Capital
EAC MP	Too Big to Fail & Bank Resolution	(25) (Reform of) Bank Regulation
EAC MP	Stress Testing Banks & Bank Lending	(17) FPC/Bank Capital and Stress Tests
EAC FP	Energy, Energy Prices, Gas & Shale Oil	(5) Real Economy/Investment
EAC FP	Real Economy & Bank Lending	(16) Borrowing Costs/Transmission of Monetary Policy
EAC FP	Financial Services & Regulation	(12) European Union
EAC FP	Scotland & Regions	(20) Scotland

Note: The table matches the labels of the semantic classes produced by Alceste with STM topics which exhibit a similar linguistic content. Appendix 3.D reports a detailed overview of the characteristic words produced by the two software.

When matching classes from Alceste and T-Lab, only those from the same corpus can be compared. For example, a T-Lab class from a financial stability hearing cannot be matched with an Alceste class from monetary policy, because they originated from different sets of documents. After comparing characteristic words and lemmas from both programs, the results of the matchings are displayed in Table 3.4. We obtain a matching rate of 0.75 (18 out of 24). That is, about 75% of classes identified in Alceste reemerge when the documents are examined in T-Lab, thereby reinforcing the hypothesis that these semantic structures reflect the nature of committee dialogue.

Table 3.5 matches our output from the Structural Topic Model with that from Alceste. A difference between the classification in STM and Alceste is that some STM topics can be related to more than one thematic class. This is because STM has been run on the whole corpus while Alceste has been used on the five hearings separately. Most likely, this does not relate to differences in software; it rather depends on the different level of aggregation in the dataset. Supporting this view, general themes (for example, related to the economic trends etc.) that appear in more than one type of committee hearing tend to be grouped under a single topic. Some topics are not matched to a thematic class. Again, this is likely due to the different corpora used. A further reason is the different parameters applied to STM - the higher number of topics (30) used with respect to about 24 thematic classes. In order to reconcile the five hearings Alceste classification with the combined hearings STM classification, we specify a 25 class thematic analysis in Appendix 3.C. The reason we do not use this is because a pre-requisite of thematic software is the existence of a unifying conceptual discourse – mixing hearings across chambers and across policy types violates this prerequisite.

An additional difference between the thematic software and the STM algorithm is that the latter identifies derives a series of 'discussion topics' which exhibit high probability on terms such as 'ask' or 'yes' (for example, topic 3 in Table 3.3), and as a consequence, are of little substantive interest. Typically themes consisting predominantly of non-substantive discussion words are absent or less prevalent in thematic software, since the number of obtained classes is smaller.[11] However, when the discourse under investigation contains a large share of unique contextual language – e.g. parliamentary/legislative committee rhetoric – this can appear as a unique theme (Schonhardt-

[11]One feature of T-Lab is that the number of classes can be set by the user, similarly as in topic modelling. When the number of classes in T-Lab is set at 25 for the combined set of documents used in this paper, for instance, a discussion topic does emerge (class 17 in Appendix 3.C).

Bailey 2006).

Despite these differences, we are able to recover about 70% of the classes produced in Alceste from the topic model.[12] This suggests a high degree of consistency in the thematic classification produced in the three cases, which we can use to study topic/class prevalence in the the corpus.

3.6 Topic/Class Prevalences

To gain a more in-depth understanding of committee dialogue, we can examine the relationships between clusters and tagged covariates. The ways in which thematic software and structural topic models study cluster prevalence are distinct yet complementary. Alceste and T-Lab model these relationships spatially, using a correspondence analysis. On the other hand, STM calculates the statistical uncertainty associated with covariate effects on latent topics, presenting the results as either point estimations, or difference estimations if the covariate is binary. We suggest that, by integrating these two approaches, it is possible to investigate the nature of committee policy discourse along multiple dimensions of interest.

We proceed as follows. First of all, we use correspondence analysis to study the sequential and interactive nature of deliberation across various hearings, specifically with respect to reciprocity. We then use specific features of STM to investigate the differences and similarities across different committees that emerge in the correspondence analysis, in particular with respect to the role of partisanship in shaping the content of the debate. As with section 3.5, the similar and independent methods employed by the different programs provide the opportunity to assess the robustness of our results, and build upon them.

3.6.1 Correspondence Analysis

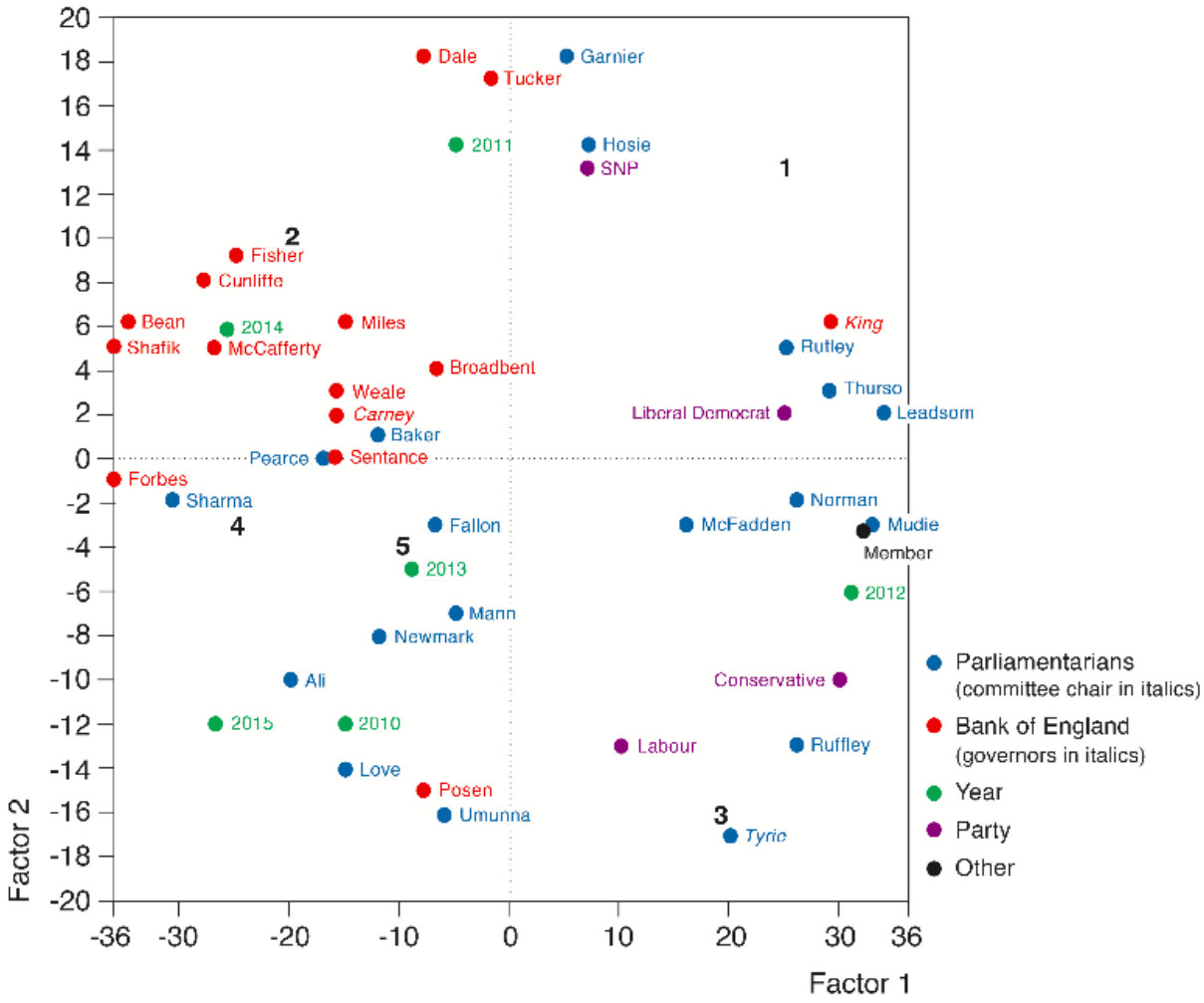
A correspondence analysis estimates the spatial relationships between classes and tagged covariates. As a type of factorial analysis, it extracts factors with the property of summarising significant information. Each factor can be interpreted as a spatial dimension that is represented by an axis whose centre is the value "0", and diverges towards both

[12] Once again, the reader can refer to Appendix 3.D for a detailed overview of the comparison process between the two software.

extremes, so that tagged covariates (tags) on opposite poles are the most weakly associated. As such, the positions of the tags is contingent on associations rather than coordinates, with the distance reflecting the degree of co-occurrence. The first factor aims to account for the maximum variation, and the second factor aims to account for the maximum of remaining variation, and so on. Hence, the total variation is divided into components along principal axes. In general, the dimensionality of the system is one less than the number of identified classes in the profile, see Greenacre (1993). The correspondence analysis provides a framework for the researcher to formulate her interpretation, rather than providing unambiguous conclusions.

An individual two dimensional representation of a correspondence analysis has been produced for each of the five corpora. For the first corpus (TSC Monetary Policy), we replicate the full analysis conducted in Schonhardt-Bailey 2015. The key findings are then summarised for the remaining four corpora.

Figure 3.1: Correspondence Analysis for TSC Monetary Policy



	% Association	% Cumulative
Factor 1	36.5	36.5
Factor 2	29.9	66.4

Class **1**	Bank of England Lending Facilities
Class **2**	Real Economy, Productivity & Competitiveness
Class **3**	Monetary Policy Decisions & Decision Making Process
Class **4**	Inflation Forecast & Outlook for Inflation
Class **5**	Forward Guidance & Outlook for Monetary Policy

Within the context of a correspondence graph, we expect to uncover evidence of reciprocity (or the lack thereof). Specifically, when the labels representing members of the committee and witnesses who are being held to account are near to one another, this suggests they are emphasising the same underlying semantic structures in similar proportions. We expect this to occur if those being held to account are addressing the concerns of the committee directly, rather than shifting the frame of dialogue.

Figure 3.1 shows a two-dimensional representation of the correspondence analysis for the Treasury Select Committee's monetary policy hearings. In this case, the two factors plotted account for 66.4% of the total variation. We observe a close proximity of both MPC and TSC members to four of the five classes. The one exception is class 3 - Monetary Policy Decisions & Decision Making Process - where only Chairman Tyrie one other MP (Ruffley) form the cluster surrounding this theme. Moreover, the close proximity of both the Conservative and Labour party tags to the class 3 tag indicates a strong cross-party consensus on the importance of challenging the Bank on its institutional decision making process and governance, including the transparency of policy decisions (see Table 3.5). In short, the TSC's monetary policy hearings exhibit a reciprocal dialogue between legislators and experts (that is, around each theme, members of both the MPC and TSC converge, meaning that both engage in the thematic dialogue (see Schonhardt-Bailey 2015)).

There are two further noteworthy observations. First, the horizontal factor appears to delineate between two types of oversight. In the left quadrants, the real economy, inflation forecast and forward guidance all pertain to economic policy, whereas the right quadrants focus on issues of accountability and governance. Second, there is a large disparity between the two Bank of England governors - Mervyn King (until 2012) and Mark Carney (2013 onwards). King's tag is nearer to class 1 and Carney closer to classes 2, 4 and 5. This is a direct result of changes in the Bank's activities post-financial crisis - there is a movement from the Funding for Lending Scheme to the new era of effective lower bound monetary policy.

An equivalent to Figure 3.1 is created for each of the remaining four hearing types, but these are not shown here (these are fully reported Schonhardt-Bailey 2015). For the TSC's fiscal policy hearings, the cumulative variation captured in a two-dimensional graph is a mere 57%, and thus the spatial representation may be less substantively robust. Nonetheless, we observe a positioning of George Osborne and Danny Alexander in roughly the centre of the spatial graph (0,0), though slightly nearer to class 5 - Public

Deficit and Debt. Fiscal policy oversight entails a "one vs. many", where a single treasury official is standing alone against the committee. This means that the opportunity for the fiscal policy witnesses to be situated in proximity to multiple classes is impossible. We also find a clear partisan split, with the Conservatives focussing on budget leaks and Labour in close proximity to the Tax and Benefits class.

Moving on to the TSC financial stability hearings, we observe a lower degree of reciprocity with classes 2 and 3 experiencing clusterings of both FPC and TSC members, but class 1 (Bank Capital, Leverage, & Lending Capacity) is predominantly the remit of BoE internal FPC members (Bailey, Haldane and Fisher). Discourse surrounding the LIBOR fixing scandal and the resignation of Barclay's CEO Bob Diamond is in close proximity to Chairman Tyrie and other TSC members. It may be the case that TSC members exhibit greater interest in those areas with a high media focus.

The correspondence graph for EAC's monetary policy hearings[13] exhibits a close overlap in word co-occurrence between classes 5 and 6 (Too Big to Fail & Bank Resolution, and Stress Testing Banks & Bank Lending) respectively. As a result, the focal points for these classes can not be statistically confirmed and are therefore not plotted. Regardless, there appears to be a partisan divide between the Conservatives and Labour tags. This is primarily due to Chairman MacGregor's predominant focus being on the theme of pensions (class 1). Finally, there is once again a horizontal factor divide between classes focussing on macroeconomic issues and those focussing on financial stability.

3.6.2 STM analysis

An important feature of STM is the possibility to test statistically hypotheses concerning the relationships between specific variables and topical prevalence.[14] In what follows, we shall test topic prevalence along two policy dimensions which have emerged from the analysis above, namely the effect of partisanship, and differences between the House of Commons and the House of Lords. These results both reinforce conclusions from the correspondence analysis above, and in themselves uncover further insights.

[13] When conducting the thematic clustering of EAC fiscal policy hearings in Alceste, instead, the classification rate for ECUs was only 46%, a particularly low value. Given its classification rate, the correspondence graph could not be produced.

[14] Existing topic model implementations (including STM) do not allow for visualising patterns of association between relevant covariates and clusters through correspondence analysis.

Partisanship

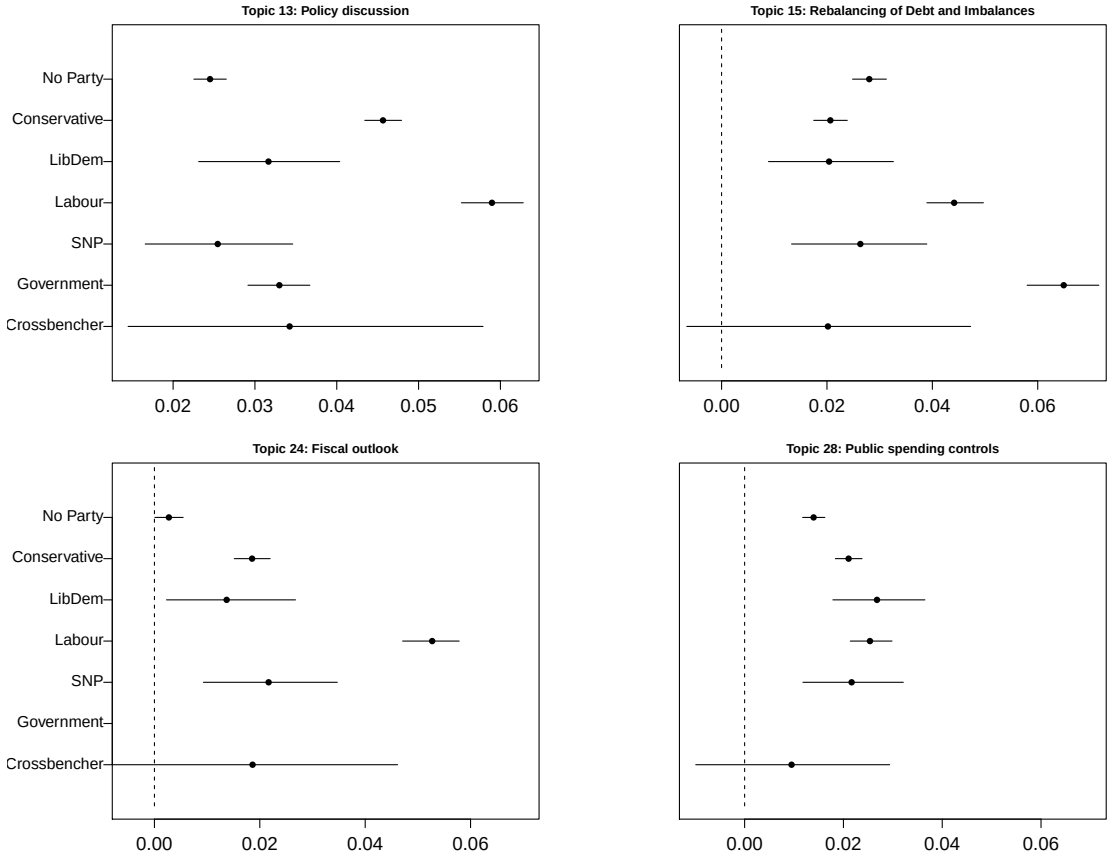
The theoretical discussion in Sections 3.1 and 3.2 suggests that deliberative accountability, to be effective, requires cross-party exchange of views and arguments. Yet, in our correspondence analyses (section 3.6.1), we find evidence of variations in the position of party labels. For example, in the TSC's fiscal policy hearings the Conservatives focussed on budget leaks, whereas Labour was in close proximity to the "Tax and Benefits" class. The STM allows us to assess the degree of statistical uncertainty associated with these observations.

We start by analysing the impact of partisanship on discussions related to fiscal policy. Figure 3.2 reports point estimates for topic proportions related to fiscal issues, using their labels from Table 3.3. Here, "no party" signifies Bank of England officials, "government" signifies Government ministers (primarily Chancellor George Osborne in Fiscal policy hearings). Crossbencher refers to non-partisan peers in the Lords' committee. These estimates are equivalent to the conditional probability of observing a particular topic in the text given the party affiliation of the speaker; the figure reports 95% confidence intervals.

Using this metric, divisions along partisan lines are clear. Speakers from the Labour Party exhibit a significantly higher probability of engaging with topics related to the distributive issues (topic 24) than those from other parties. At the same time, speakers from the Government (again primarily the Chancellor) exhibit a greater proportion of attention to deficit and debt (Topic 15). The latter is consistent with the finding in section 3.6.1 that the Government's discourse is evenly distributed across most classes, but is slightly pulled towards class 5 - Public Deficit and Debt. In addition, the results in Figure 3.2 suggest the existence of an ideological divide. Labour Party members engage more frequently with redistributive aspects of the budget while members of the Conservative-Liberal Democratic Government talk more frequently about implications for debt and deficits. This finding, not immediately evident using the correspondence analysis method discussed above, is consistent with existing accounts of party ideological positioning on economic policy (see Laver and Garry 2000; Laver, Benoit, and Garry 2003). It suggests that, in contested areas such as fiscal policy, partisanship exerts a significant role in shaping the content of deliberation.

To further understand this partisan divide, we should consider cases where the party narrative is less prominent. As an example, Figure 3.3 reports the point estimates of

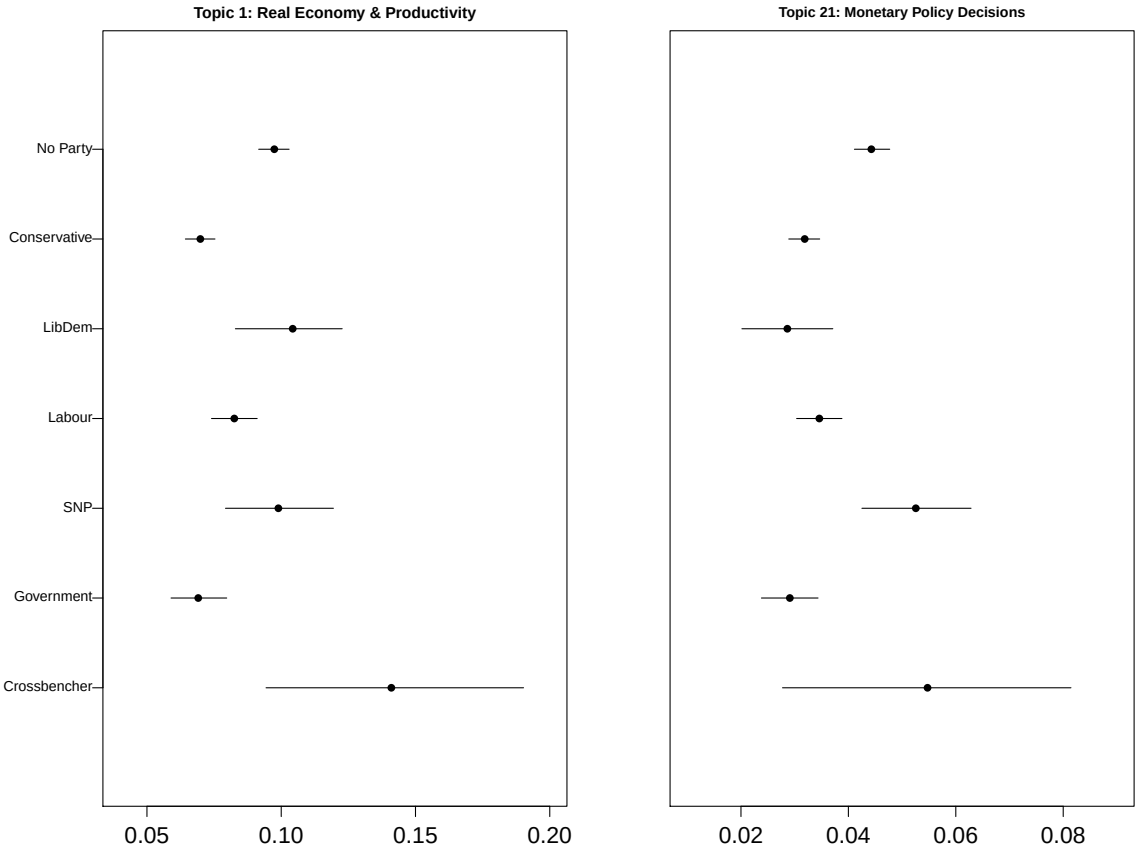
Figure 3.2: By-party Topic Proportions for Fiscal Policy



topic prevalences across parties for discussions related to the real economy (topic 1) and concerning the analysis of monetary policy decisions (topic 21). As expected, in these cases the partisan divide is less evident. This is particularly true for speakers from the Labour and the Conservative parties, who instead exhibit large differences in topic proportions for fiscal topics (Figure 3.2 above). These considerations suggest a partisan divide in deliberation emerges more clearly in the case of fiscal policy oversight (politically more contested) as opposed to monetary policy. This is consistent with the findings obtained using correspondence analysis, which indicate a certain degree of cross-party consensus in the context of monetary policy oversight, especially with respect to issues of governance and accountability.

More precisely, when discussing fiscal policy, speakers from different parties seem to systematically engage with different topics. This arguably limits the scope for gen-

Figure 3.3: By-party Topic Proportions for Non-politicised Policy Areas



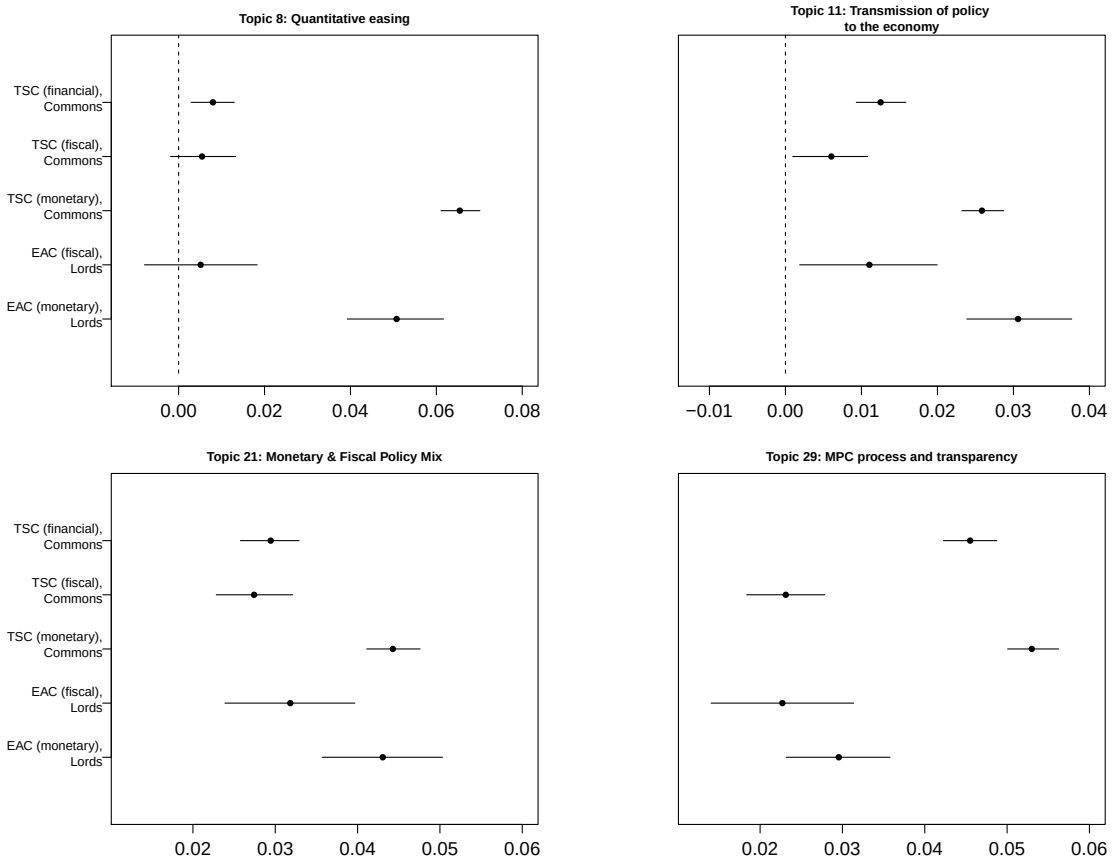
uine deliberation in this particular policy area, something which is also reflected in the low percentage of cumulative variation captured by the correspondence analysis of TSC hearings on fiscal policy (see Section 6.1). The analysis carried out in this section allows relating the absence of reciprocity uncovered in the correspondence analysis of TSC hearings directly to a partisan divide. The pattern of arguments used by actors involved in fiscal oversight appear to follow their political affiliations rather than constituting a reciprocal exchange of views, therefore suggesting more of a "notice posting" form of discourse rather than to genuine deliberation. An important finding is that such partisan effect is absent in the context of monetary policy hearings, which suggests that the political salience and level of technical sophistication of the policy area discussed has some effects on the content of the debate. The next section investigates the latter point in greater detail by focusing on differences in deliberation between the House of

Commons and the House of Lords.

Chamber Affiliation

An equivalent question can be posed regarding the effect of chamber affiliation (Commons for TSC, and Lords for EAC) on topic proportions. To test this, Figure 3.4 reports point estimates of STM topic proportions for each committee for topics related to oversight of the Bank of England.

Figure 3.4: By-committee topic proportions for monetary policy

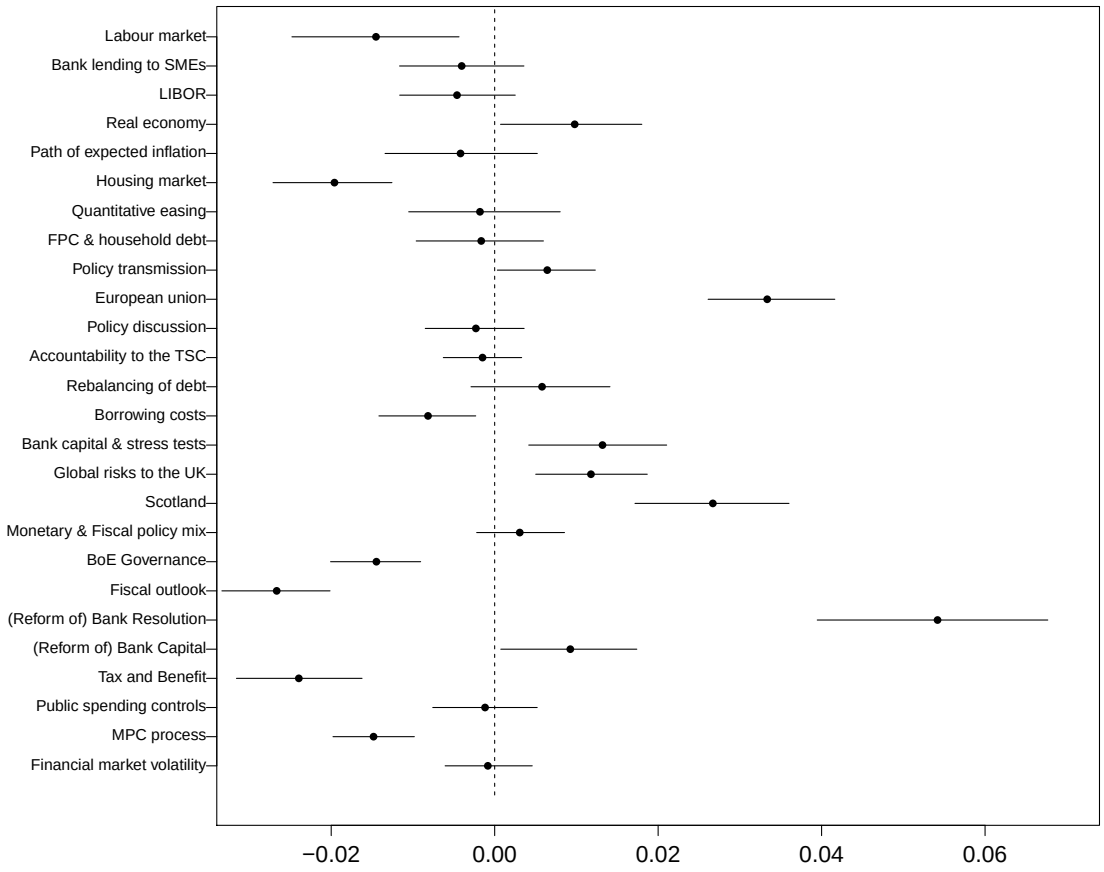


In line with our Alceste findings, the figure shows that TSC hearings exhibit a higher topical prevalence on topic 29 (MPC decision-making process). This is not true only for TSC hearings on monetary policy but also for those on financial stability. At the same time, these results indicate no statistical difference between TSC and EAC on

other aspects of monetary decisions. Hence they confirm the idea that TSC committee members are comparatively more focussed on discussing the internal decision making processes of the Bank of England (e.g. for the MPC this included its transparency).

To further investigate the effect of chamber affiliation on dialogue, Figure 3.5 shows the estimated differences between topics addressed in the House of Commons and the House of Lords, for the full set of (non-discussion) topics identified by the model. Note that differently from the point estimates presented in figures 3.2-3.4, Figure 3.5 reports the expected difference in topic proportions for EAC hearings as compared to TSC, with a those to the right of 0 being more prevalent in the Lords and those to the left more prevalent in the Commons. In this case, estimates are obtained by controlling for both party affiliations and the type of policy hearing.

Figure 3.5: Differences in topic proportions by Chamber



In line with the idea that deliberation in the EAC reflects the experience and exper-

tise of committee members, we see a positive and significant difference for a number of technical topics including for example topic 5 (Real Economy/Investment), 12 (European Union) and 26 ((Reform of) Bank Regulation). Overall we find a significant amount of correlation between the correspondence analysis for Alceste, and our point estimations from the STM. Furthermore, the STM provides further insights through the visualisation of the statistical uncertainty associated with estimates of topic proportions across covariates of interest. Interestingly, the Lords is more strongly associated with both 25 ((Reform of) Bank Resolution) and 26 ((Reform of) Bank Capital) than the TSC despite not having a dedicated financial stability oversight committee hearing. This suggests that EAC hearings are discussing financial stability alongside their statutory objectives.

3.7 Conclusions

We have sought two goals in this paper –one substantive and one methodological. Our substantive goal sought to explore variations in the setting of oversight committees (across economic policy and across parliamentary chamber) in order to gauge deliberative quality. We employed two indicators to measure the quality of deliberation – reciprocal dialogue and non- (or cross-) partisanship. We contended that reciprocity and non-partisanship might vary according to who and what is being held to account. For instance, to what extent does partisanship shape oversight hearings on fiscal policy relative to monetary policy and financial stability? In the case of the former, backbench parliamentarians are holding frontbench parliamentarians to account; in the latter, parliamentarians are holding unelected policy experts to account. Does the nature of the deliberative process systematically vary according to these differences? Moreover, we explored the extent to which the institutional context for oversight hearings (that is, House of Commons versus House of Lords) matters for deliberation. Both chambers have select committees that oversee economic policy, even though the TSC is the primary oversight committee (the Commons' TSC has the statutory responsibility for conducting oversight, although the Lords' EAC nonetheless conducts its own investigations into various aspects of economic policy). Our question here is, does deliberation in the (elected) committee of MPs differ from deliberation occurring in the (unelected) committee of peers?

Thematic and topic model textual analysis approaches are consistent in the follow-

ing findings. First, fiscal policy hearings are clearly distinct in their partisan content. However, each textual analysis approach captures a different dimension of this partisan story. Thematic software finds virtually no partisan cleavage between the two main parties (Conservative / Labour) in monetary policy, but in fiscal policy, MPs of the minority party (Labour) tend to have a greater say in questioning the Conservative chancellor. The correspondence analysis in thematic software also captures the impact of this partisanship on the deliberative process. That is, hearings with Bank officials tend to exhibit greater reciprocity in deliberation, whereas those on fiscal policy exhibit more of a "talking across" one another phenomenon. In monetary policy, MPs and peers tend to converge with MPC members on each theme (with the exception of the theme of monetary policy decision making, where Chairman Tyrie was more singularly focused). In fiscal policy, the Chancellor tends to speak to one theme, while committee members focus on other themes.

The STM analysis adds to the partisan story the ability to gauge point estimates for topic proportions across different topics, and so allows us to observe that Labour Party committee members have a significantly higher probability of engaging with topics related to distributive issues that members from the other parties. And, witnesses from the Government (namely, Chancellor Osborne) exhibit a greater proportion of attention to the topic of the deficit and debt.

We also explore differences between the Commons' committee and the Lords' committee. From the thematic software (particularly evident in the correspondence analysis), we saw that the TSC was uniquely focused on issues of the institutional governance of the Bank of England and the process of decision making within the MPC (e.g., transparency), whereas the EAC appeared to divide attention among a number of lesser related topics (e.g., Scotland, energy policy). From the STM, we could explore the array of topics for each committee, across all the policy hearings. From Figure 3.5, we could observe the expected difference in the topic proportions for the EAC relative to the TSC. Here, the differences became more prominent –e.g., for the EAC, reforming bank resolution and bank capital, Scotland, and the EU were particularly distinctive topics; while for the TSC, the areas of predominant focus included fiscal outlook, tax and benefits, housing, the labour market, Bank of England governance, and the process of MPC decision making.

Our second broad goal in this paper is methodological. We have maintained that by conducting multiple automated content analyses on the same corpus, we can provide a

more comprehensive empirical assessment of our two indicators of deliberative quality in oversight hearings. Using the correspondence analysis in the thematic software, we are able to capture visually the extent to which committee members and witnesses talk "to" as opposed to "across" one another. A thematic approach also captures part of the partisan cleavages across economic policy, but the STM approach extends the partisan story by providing point estimates for topic proportions across different topics, thus allowing us to better compare probabilities across topics and parties.

In sum, we have drawn on both thematic and topic modelling approaches to broaden our understanding of deliberation in parliamentary oversight committee hearings. We have found that the content (in themes and topics) is broadly similar for both approaches (roughly 70% in a direct comparison between one of the thematic packages and the STM approach). Having a solid common understanding of the content of the hearings, we have then exploited aspects of each software to assess indicators of deliberative quality. In the end, we have found the two approaches to be complementary. Indeed, by employing multiple textual analysis approaches, we deepen our understanding of both the underlying content of the corpora, but we also allow for a broader methodological toolkit. From the thematic analysis, we better understand the potential for reciprocal discussions within a group setting (which is a key concern for deliberative democracy), while from the STM, we can generate both point estimates and differences in topic proportions. Arguably, our use of multiple textual analysis software lessens the elegance of the analysis as one is forced to explain a much broader array of methodologies; however, our simple point is that thematic and topic approaches complement rather than conflict with one another.

Appendix

3.A List of Hearings

House of Commons Treasury Select Committee:

Monetary Policy Hearings:

28 July 2010, Inflation Report
10 November 2010, Inflation Report
1 March 2011, Inflation Report
28 June 2011, Inflation Report
25 October 2011 [Quantitative Easing]
28 November 2011, Inflation Report
29 February 2012, Inflation Report
26 June 2012, Inflation Report
27 November 2012, Inflation Report
25 June 2013, Inflation Report
12 September 2013, Inflation Report
26 November 2013, Inflation Report
24 June 2014, Inflation Report
10 September 2014, Inflation Report
25 November 2014, Inflation Report
24 February 2015, Inflation Report

Fiscal Policy Hearings:

15 July 2010 [Budget]
4 November 2010 [Spending Round]
29 March 2011 [Budget]
27 March 2012 [Budget]
26 March 2013 [Budget]
11 July 2013 [Spending Round]
17 December 2014 Autumn Statement

Financial Stability Reports and Hearings 2011-2015

17 January 2012: (December 2011 FSR)
17 July 2012: (June 2012 FSR)
15 January 2013: (November 2012 FSR)
2 July 2013: (June 2013 FSR)
15 January 2014: (November 2013 FSR)
15 July 2014: (June 2014 FSR)
14 January 2015: (December 2014 FSR)

House of Lords Economic Affairs Committee:

Monetary Policy Hearings:

16 November 2010: Meeting with the Governor
27 March 2012: Economic Outlook (Meeting with Governor and MPC members)
17 December 2013: Meeting with the Governor of the Bank of England
10 March 2015: Meeting with the Governor of the Bank of England

Fiscal Policy Hearings:

30 November 2010: Economic Outlook (Meeting with Chancellor and Treasury Staff)
8 December 2011: Economic Outlook (Meeting with Chancellor and Treasury Staff)
4 February 2014: Meeting with the Chancellor of the Exchequer

3.B Model selection in STM

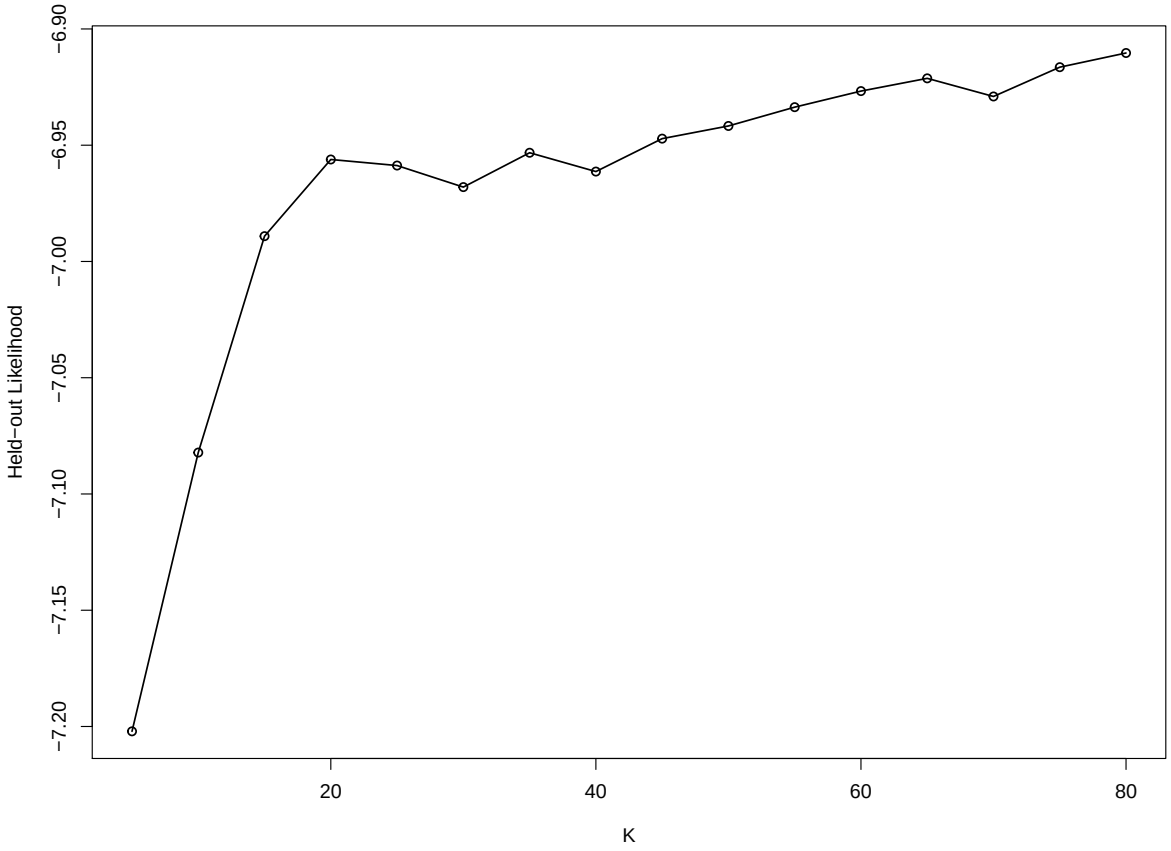
With respect to fitting the algorithm to the corpus, two features of STM should be noted. First, the user must define the number of topics, K, prior to the analysis. In this case, we opt for a model with K=30 topics after exploring the performances for alternative specifications ranging from 25 to 40 topics. Such topic range was suggested by exploring model performance for the held-out likelihood, a commonly used metric of model fit for topic model (Wallach et al. (2009)), for the dataset of interest. Furthermore, as mentioned a key feature of STM is the possibility of comparing topic prevalence across hearings. For this reason, we fit the algorithm to the a dataset comprising the five hearings combined.

The held-out likelihood is the probability that a given model correctly predicts a set of words intentionally left out from the estimation, namely the estimation of words probability after some of those words have been removed from the text. The essence of this method is to check which model gives the best out-of-sample predictions, i.e. it is able to better explain the left-out set of words.

The held-out likelihood for a sequence of K = 5, 10, 15 ... 80 topics is reported in Figure 3.B.1. The Figure shows that the held-out likelihood is low for models with less than 20 topics, it remains broadly stable for K between 20 to 40 topics, and it marginally increases afterwards. While Figure 6 suggests a model with 80 topics would provide the best model fit among those considered, increasing the number of topics to 80 would probably imply loss of generality for the interpretation, as topics become over-identified (see Grün and Hornik 2011, p. 13). In general, interpretability is also an important criterion for choosing the number of topics (Blei 2012).

Taking these considerations into account, we opt for a model with K=30 topics after exploring the performances for alternative specifications ranging from 25 to 40 topics (the shaded grey area in Figure 6). Figure 6 suggests models in this range provide a reasonable fit of the text; at the same time, the limited number of topics should allow direct comparison with the semantic classes derived in Alceste and T-Lab.

Figure 3.B.1: Held-out Likelihood for $K = 5, 10, ..., 80$



3.C 25-class T-Lab Clustering

Table 3.C.1: Characteristic Words and Labels for a 25-Class Thematic Analysis

	Characteristic Words	Label
1	labour capacity spare market gap	Spare Capacity and Labour Markets
2	benefit housing House child claim	Unemployment and Housing Benefits
3	banks scheme lend fund incentive	Lending and Bank Lending Scheme
4	F_P_C power P_R_A board recommendation	FPC/PRA
5	inflation target percent remit expectation	Inflation Targeting and Expectations
6	billion plan pounds spend set_out	Public Speding and Budget
7	union monetary arrangement currency euro	EMU and Fiscal Integration
8	yield gilt asset_purchases Q_E unwind	Quantitative Easing
9	treasury official secretary minister press	Treasury Department and Officials
10	economy export rebalancing consumption recovery	International Trade and Demand
11	reserves deposit hong G_D_P kong	Foreign Currency Reserves
12	unite united rest kingdom solution	United Kingdom
13	bond assets buy corporate purchase	Asset Purchasing
14	institution regulation capital leverage requirement	Leverage Ratios/Capital Requirements
15	interest_rates raise rate long-term low	Interest Rates
16	tax budget chancellor _YR_MARCH12 penny	Taxation (particularly income tax)
17	question answer ask quick _R_CHAIR	Questioning (disc.)
18	issue service governor majority financial	Finance and Scottish Independance
19	price risk inflation energy commodity	Price Changes and Inflation
20	growth productivity wage average data	Productivity and Wage Growth
21	public expenditure deficit decision political	Public Expenditure and the Defecit
22	home build local social building	Housing Policy
23	contingency event okay have– but–	Bank of England Contingency Planning
24	monetary policy guidance tighten stance	Path of Monetary Policy/Forward Guidance
25	small enterprise business medium-sized company	SMEs

Note: A 25 class model is chosen because this is equivalent to the number of non-discussion STM topics.

3.D Matching Software Outputs

Alceste and Structural Topic Model:

TSC Monetary Policy:

Alceste class 1: lend, small, bank, size, enterprise
Topic 2: bank lend small fund credit compani busi
Alceste label: Bank of England Lending Facilities
STM: Bank Lending to SMEs

Alceste class 2: growth econom income product
Topic 1: growth economi product recoveri see unemploy data pick labourmarket
Alceste label: Real Economy, Productivity & Competitiveness
STM: Labour Market/Economic Growth

Alceste class 3: monetary_polic; committee, discuss, decision
Topic 29: view discuss decis committe differ meet whether member monetarypolicy-committe
Alceste Label: Monetary Policy Decisions & Decision Making Process
STM label: MPC Process and Transparency

Alceste class 4: inflation forecast target look expect
Topic 6: inflat percent expect target forecast look mediumterm rise forwardguid will guidanc
Alceste Label: Inflation Forecast, Expectations & Outlook for Inflation
STM label: Path of Expected Inflation

Alceste class 5: guidance, interest_rate, threshold, tighten, forward_guidan
Topic 6: inflat percent expect target forecast look mediumterm rise forwardguid guidanc
Alceste Label: Forward Guidance & Outlook for Monetary Policy
STM label: Path of Expected Inflation

TSC Fiscal Policy:

Alceste class 1: tax income benefit people percent system
Topic 27: tax percent peopl increas pound cut work measur benefit take fair system income
Alceste Label: Housing & Household Indebtedness
STM label: Fiscal Policy / Tax and Benefits

Alceste class 2: department, cabinet contract ring process secretary minister
Topic 4: process minist involv consult secretari treasuri prime chief offici part
Alceste Label: Budget Process and Role of Ministers
STM label: LIBOR

Alceste class 3: committee chancellor brief office_for_budg budget inform
Topic 14: committe think made interest public good inform
Alceste Label: Budget Leaks
STM label: Accountability to the TSC

Alceste class 4: small sector businesses private bank fund regional
Topic 5: invest job busi project privatesector will new industri creat region
Alceste Label: Economic Effects of Budget
STM label: Real Economy/Investment

Alceste class 5: deficit, structural, fiscal budget_deficit, fiscal, world
Topic 15: economi countri debt econom deficit problem export challeng growth world
Alceste Label: Public Deficit and Debt
STM label: Rebalancing of Debt and Imbalances

TSC Financial Stability:

Alceste class 1: capital bank asset ratio sheet institution
Topic 26: bank capit liquid balancesheet account asset fsa crisi posit hold
Alceste Label: Bank Capital, Leverage, & Lending Capacity
STM label: (Reform of) Bank Capital

Alceste class 2: price, market, econom, debt mortgage rate interest_rates rise income
Topic 7: scheme hous will new home mortgag suppli housepric build increas
Alceste Label: Housing & Household Indebtedness
STM label: Housing Market/New Home Building

Alceste class 3: committee court board decision oversight chancellor parliament report
Topic 23: report suggest evid review respons independ court board oversightcommitte
Alceste Label: Governance of the Bank of England
STM label: Bank of England Governance/Oversight Committee

Alceste class 4: ask governor thank answer andrew subject helpful conference new_york_fed
Topic 4: libor cabinet perman depart discuss contract situat bba work
Alceste Label: Barclays and LIBOR
STM label: LIBOR

EAC Monetary Policy:

Alceste class 1: assets asset_purchas gilt yield pension purchase private
Topic 11: interestr, mean, therefor, might, effect, pension, rise, obvious, suppos
Alceste Label: Pensions, Savings & Annuities
STM label: Transmission of Policy to the Economy

Alceste class 2: inflation growth percent interest_rate price consistent
Topic 6: inflat percent expect target forecast look mediumterm
Alceste Label: Real Economy & Economic Forecast
STM label: Path of Expected Inflation

Alceste class 3: prudent financial_policy prudential_regu supervis prudential_regu financial_servic financial_stabili
Topic 10: risk financialst take financialpolicycommitte tool perspect mortgag type potenti term fpc debt respons valu action stabil
Alceste Label: Financial Stability & Macro Prudential Policy
STM label: FPC/Household Debt

Alceste class 4: want political auditors competitivenes reform politic
Topic 26: air system incom analysi impact make includ chang welfar way
Alceste Label: Banking & Bank Regulation
STM label: (Reform of) Bank Capital

Alceste class 5: fail buffer big institut border trouble bail systemically taxpayer
Topic 25: bank regul problem fail issu structur big competit new way import system rule
Alceste Label: Too Big to Fail & Bank Resolution
STM label: (Reform of) Bank Regulation

Alceste class 6: test ring fence stress standard resilient individual capitalised
?Topic 17: fpc power set institut need leverageratio capit system stresstest will bank
Alceste Label: Stress Testing Banks & Bank Lending
STM label: FPC/Bank Capital and Stress Tests

EAC Fiscal Policy:

Alceste class 1: gas regime shale local oil region energy
Topic 5: region particular peopl support area price part help publicsector countri oil
Alceste Label: Energy, Energy Prices, Gas & Shale Oil
STM label: Real Economy/Investment

Alceste class 2: percent medium small credit enterprise
Topic 16: rate cost peopl pay borrow high look
Alceste Label: Real Economy & Bank Lending
STM label: Borrowing Costs/Transmission of Monetary Policy

Alceste class 3: financial regul service european_unio bank prudent legislat centre proper
Topic 12: nation countri control requir european will london british legisl europea-nunion
Alceste Label: Financial Services & Regulation
STM label: European Union

Alceste class 4: scotland scottish establish arrangement fiscal
Topic 20: unit state kingdom reserv scotland global relat gdp
Alceste Label: Scotland & Regions
STM label: Scotland

Alceste and T-Lab:

TSC Monetary Policy:

Alceste class 1: lend, small, bank, size, enterprise
T-Lab class 2: bank lend small enterprise medium-sized fund
Alceste label: Bank of England Lending Facilities
T-Lab label: Bank Lending to SMEs

Alceste class 2: growth econom income product
T-Lab class 4: growth price interest_rates house income consumption
Alceste label: Real Economy, Productivity & Competitiveness
T-Lab label: Real Economy and House Price Growth

Alceste class 3: monetary_polic committee discuss decision
T-Lab class 5: gilt quantitatice_easing monetary_policy_committee asset
Alceste Label: Monetary Policy Decisions & Decision Making Process
T-Lab label: Quantitative Easing Discussions

Alceste class 4: inflation forecast target look expect
T-Lab class 1: inflation percent forecast labour target expectation
Alceste Label: Inflation Forecast, Expectations & Outlook for Inflation
T-Lab label: Outlook fro Inflation and Inflation Expectations

Alceste class 5: guidance, interest_rate, threshold, tighten, forward_guidan
UNMATCHED

TSC Fiscal Policy:

Alceste class 1: tax income benefit people percent system
T-Lab class 4: tax rate pounds income billion increase measure oil
Alceste Label: Housing & Household Indebtedness
T-Lab label: Income Tax Rates

Alceste class 2: department, cabinet contract ring process secretary minister
T-Lab class 3: department process minister secretary contract prime chief
Alceste Label: Budget Process and Role of Ministers
T-Lab label: Ministerial/Cabinet Involvement in the Budget Process

Alceste class 3: committee chancellor brief office_for_budg budget inform
UNMATCHED

Alceste class 4: small sector businesses private bank fund regional
T-Lab class 5: bank banks committee small business lend
Alceste Label: Economic Effects of Budget
T-Lab Label: Bank Lending to SMEs

Alceste class 5: deficit, structural, fiscal budget_deficit, fiscal, world
T-Lab class 2: economy debt deficit economic country fiscal structural UK
Alceste Label: Public Deficit and Debt
T-Lab label: Fiscal Deficit and Government Debt

TSC Financial Stability:

Alceste class 1: capital bank asset ratio sheet institution
UNMATCHED

Alceste class 2: price, market, econom, debt mortgage rate interest_rates rise income
T-Lab class 1: risk lend mortgage price house capital UK asset economy debt
Alceste Label: Housing & Household Indebtedness
T-Lab label: Bank Stress Tests, Mortgage Lending and House Prices

Alceste class 3: committee court board decision oversight chancellor parliament report

T-Lab class 2: Committee oversight member M_P_C decision court view
Alceste Label: Governance of the Bank of England
T-Lab label: Bank of England Governance and FPC/MPC

Alceste class 4: ask governor thank answer andrew subject helpful conference new_york_fed
T-Lab class 3: L_I_B_O_R B_B_A barclays evidence consultation week dark
Alceste Label: Barclays and LIBOR
T-Lab label: LIBOR

EAC Monetary Policy:

Alceste class 1: assets asset_purchas gilt yield pension purchase private
T-Lab class 5: asset pension gilt yield annuity purchase buy Q_E
Alceste Label: Pensions, Savings & Annuities
T-Lab label: QE and Pension Investment

Alceste class 2: inflation growth percent interest_rate price consistent
T-Lab class 1: inflation growth economy target percent productivity expectation price
Alceste Label: Real Economy & Economic Forecasts
T-Lab label: Inflation Outlook and the Economy

Alceste class 3: prudent financial_policy prudential_regu supervis prudential_regu financial_servic financial_stabili
T-Lab class 4: leverage institution ratio system regulation prudential supervision Basel
Alceste Label: Financial Stability & Macro Prudential Policy
T-Lab label: Leverage Ratio for Banks

Alceste class 4: want political auditors competitivenes reform politic
UNMATCHED

Alceste class 5: fail buffer big institut border trouble bail systemically taxpayer
T-Lab class 2: banks capital banking_system debt requirement Irish global lend
Alceste Label: Too Big to Fail & Bank Resolution
T-Lab label: Bank Capital and Lending

Alceste class 6: test ring fence stress standard resilient individual capitalised
UNMATCHED

EAC Fiscal Policy:

Alceste class 1: gas regime shale local oil region energy
T-Lab class 1: tax impact carbon spend decade benefit local rate pricel
Alceste Label: Energy, Energy Prices, Gas & Shale Oil
T-Lab label: Tax Measures (notably energy)

Alceste class 2: percent medium small credit enterprise
UNMATCHED

Alceste class 3: financial regul service european_unio bank prudent legislat centre proper
T-Lab class 3: financial bank service Vickers sector banks regulation ask regulator
Alceste Label: Financial Services & Regulation
T-Lab label: EU/Financial Services/Regulation

Alceste class 4: scotland scottish establish arrangement fiscal
T-Lab class 4: fiscal union scotland vote monetary political scottish bad
Alceste Label: Scotland & Regions
T-Lab label: Scotland

Chapter 4

Central Bank Transparency, Independence, and Credibility

A long literature suggests that, in the absence of credible commitments, central banks might find it difficult to attain low inflation (e.g., Barro and Gordon 1983b). As a result, managing inflation expectations is central to several aspects of monetary policy (King, Lu, and Pastén 2008). An example is the establishment of independent central banks. More recently, policymakers have adopted communication policies to reduce uncertainty about their decisions.

This study examines how transparency affects policymakers' ability to manage expectations and how this effect interacts with central bank independence (CBI). The motivation is twofold. First of all, despite a large literature on central bank communication, there is still little agreement concerning the effectiveness of transparency as a way to establish credibility. While some scholars suggest that an open approach to communication has positive effects on policymakers' ability to control inflation (Adrian, Laxton, and Obstfeld 2018b), others argue that changes in transparency may have little or no effects on economic outcomes (e.g., Dale, Orphanides, and Osterholmc 2011). Understanding which of these effects prevails is arguably important for broader debates about monetary credibility (e.g., IMF 2018, ch. 2). In addition, little empirical research exists concerning the conditions which favour the use of communication, particularly how the institutional environment in which policymakers operate affects the impact of their announcements. This is puzzling given that, as Dincer and Eichengreen (2007) note, we can expect the choice of transparency –and, by extension, its effects- to depend also on

institutional factors shaping central banks' credibility. As legal independence is often seen as an important condition to attain low and stable inflation (e.g., Alesina and Stella 2010; Laurens, Arnone, and Segalotto 2016), it is natural to ask whether this policy interacts with central banks' announcements in promoting credibility.

The main argument advanced in this paper is that transparency and independence constitute complementary policy instruments. When legal CBI does not provide perfect information about the actual (de facto) degree of autonomy of monetary authorities, a more open approach to communication can help policymakers to strengthen their reputation. To support this view, in section 4.2 I explore a version of Barro and Gordon's (1983) time inconsistency framework. In the model, a central bank decides the value of a monetary instrument and the level of transparency (high or low) to communicate its decision to the public. As in Faust and Svensson (2001), transparency relates to the amount of information the central bank reveals about the intended effects of its policies; high (low) transparency makes it easier (more difficult) for the public to understand the central bank's intentions concerning inflation. Preferences are standard. The central bank dislikes deviations of inflation from a target level; its preferences over the output gap, in turn, depend on its de facto independence. The public does not directly observe de facto autonomy, but only the level of policymakers' legal (de jure) independence. Private agents use this information and observed central banks' policies to anticipate future inflation.

The framework suggests several testable predictions. First of all, making additional information about central banks' actions available to the public reduces uncertainty about policymakers' intentions. This helps the private sector to form correct expectations and allows monetary authorities to commit to a specific inflation level. In line with existing contributions that relate monetary communication to credibility (e.g., Geraats 2002; Adrian, Laxton, and Obstfeld 2018a), I anticipate a decrease in inflation following an increase in central banks' transparency. Moreover, because the public uses information on both de jure independence and monetary decisions to form expectations, transparency and CBI are complementary. While legal autonomy lowers the public's ex-ante inflation expectations, communication helps policymakers to signal their commitment to price stability. My second expectation is that the impact of an increase in transparency on inflation is stronger when pre-existing CBI is high.

The subsequent empirical study tests these expectations using data for 95 countries in the period from 1998 to 2010. My empirical approach uses discrete changes in cen-

tral banks' communication policy to distinguish the impact of transparency. Building on recent work by Furceri, Loungani, and Ostry (2019), I identify reforms in communication using large positive changes in the index of transparency proposed by Dincer and Eichengreen (2007; 2009; 2014). I then compare inflation within countries in the aftermath of these reforms using a difference in differences approach to assess the effects of communication, both in isolation and interacted with measures of CBI. This method controls for unobserved confounders which might drive both inflation and transparency in the long-run, a common concern in the study of economic institutions (Henry 2007; Furceri, Loungani, and Ostry 2019). In line with the predictions, I uncover a negative impact transparency on inflation. In my estimates, inflation is about one fifth lower in years in which central banks have adopted greater disclosures as opposed to remaining years. In addition, I find a negative and significant interaction effect between legal CBI and communication policy. As expected, reforms in central bank transparency have a stronger impact on inflation for relatively high levels of legal independence. Both results are robust to a variety of sensitivity checks. I also show that CBI without transparency does not have any significant effect on prices, supporting the idea of complementarities between the two instruments.

The main implication of the study is that central bank transparency matters for policy and that, to be effective, public announcements must be supported by an institutional framework that protects central banks' autonomy. This perspective differs from most existing contributions on transparency, which often study the effect of communication in isolation (Blinder, Ehrmann, et al. 2008). It suggests that the institutional environment plays an important role in mediating the impact of monetary announcements. In doing so, the paper contributes also to the large literature on central bank independence (e.g., Drazen 2000), especially showing that communication should be considered an important aspect of central banks' delegation and institutional design. The framework has also implications for different aspects of policy. For example, in recent years several governments have delegated financial stability tasks to monetary authorities (e.g., 2018). Given that financial policy can interact with price stability in various ways (Nier et al. 2012; Bean 2015; Kamber, Karagedikli, Smith, et al. 2015), it may be important for policymakers to use additional communication to clarify the importance they attach to controlling inflation when facing additional financial stability objectives. From a broader perspective, the analysis suggests that communication favours public understanding of central banks' decisions; this is likely relevant for current debates about

central banks' accountability (e.g., Kohn 2013; Yashiv 2020).

The study proceeds as follows. Section 4.1 reviews the relevant literature. Section 4.2 discusses the theory and outlines the testable predictions. Section 4.3 describes the data and the empirical strategy. Section 4.4 reports the results. Section 4.5 concludes.

4.1 Background literature

This paper draws on the literature on central bank transparency as well as on previous contributions on monetary delegation. Below I review these strands of the literature and outline the main contributions of the study. The following section engages in greater detail with the theoretical framework used in the analysis.

4.1.1 Central bank transparency and credibility

Several contributions investigate the effect of central bank transparency on expectations. Faust and Svensson (2001); Geraats (2002; 2005; 2007) and Frankel and Kartik (2015) consider models in which the public is both uncertain about central banks' objectives and about the information that authorities use to reach policy decisions. In these theories, transparency about policy increases the public's sensitivity to authorities' actions, which has a positive impact on credibility. Different studies, however, suggest the opposite effect. For example, it has been argued that excessive transparency can result in additional noise around policymakers' objectives (Dale, Orphanides, and Osterholmc 2011), or that it can induce economic agents to attach too much weight to central banks' announcements (Morris and Shin 2002; Morris, Shin, and H. Tong 2006).

The findings discussed below are consistent with the first view; in particular, I suggest that transparency has a positive impact on policymakers' ability to control inflation. Here, I explicitly connect this result to uncertainties related to monetary delegation; if legal autonomy is imperfectly observed, being transparent about policy decisions helps central banks to signal their intentions for inflation. This conclusion, like much of my modelling framework, builds on the aforementioned studies by Faust and Svensson (2001) and Frankel and Kartik (2015). Differently from these authors, however, I assume the choice of transparency to be controlled by the central bank. As further discussed in section 4.3, this assumption describes well the large majority of reforms in communication observed in practice, allowing to derive testable predictions.

Additional contributions of this paper are empirical. First of all, I directly evaluate the impact of transparency on inflation, something for which empirical evidence is arguably still limited (Blinder, Ehrmann, et al. 2008).[1] Previous contributions on this topic, including those by Stasavage (2003), Chortareas, Stasavage, and Sterne (2002), Demertzis and Hallett (2007), and Crowe and Meade (2008) adopt cross sectional data to explore the relationship between central banks' transparency and inflation. While pointing to a negative correlation, the use of averages over long periods of time makes it difficult to identify relevant effects.

Successive studies by Dincer and Eichengreen address this issue by developing a measure of central bank transparency across country over several years and assessing its relationship with inflation over several year (Dincer and Eichengreen 2007; 2009; Eichengreen and Dincer 2014). The authors find again a negative correlation between transparency an inflation; however, the empirical results do not appear robust to the use of different controls. An additional concern with Dincer and Eichengreen's approach is that the long-run focus of the analysis makes it difficult to rule out the effect of unobserved factors. A contribution of this paper is to use a difference in differences approach which looks at the impact of discrete changes in the Dincer and Eichengreen's indicator distinguish the effect of transparency. I also control for time effects, political variables, and different samples in the analysis, which previous contributions do not generally consider.

Finally, I extend the existing literature by examining the relationship between transparency and the institutional environment in which policymakers operate. Aforementioned studies by Crowe and Meade (2008) and Dincer and Eichengreen (2014) suggest that variations in transparency might depend also on institutional factors, including independence. Nevertheless, they do not test whether these factors drive the impact of communication as well. In this study, I provide evidence that the impact of transparency is mediated by central banks' legal independence. The idea of complementarities between CBI and communication policy has been previously explored within the inflation targeting (IT) literature (e.g., Mishkin and Schmidt-Hebbel 2001; Hu 2006; Batini and Laxton 2006; Samarina, Terpstra, and De Haan 2014). I extend these analyses by fo-

[1] There exists a large literature within empirical economics investigates the impact of central bank communication on financial assets and forecasts (e.g., Gurkaynak, Sack, and Swanson 2004; Swanson 2006; Blinder, Ehrmann, et al. 2008; Hansen, McMahon, and M. Tong 2018; Schmeling and Wagner 2019). This perspective is different from focus of the analysis presented in this paper, which measures the impact of communication policy on actual inflation trends.

cusing on the impact of central bank communication more broadly.[2]

4.1.2 Central bank delegation and independence

By focusing on the relationship between central banks' transparency and independence, the study draws also on the large literature on monetary delegation. Like much of existing contributions on the topic, my analysis builds on Barro and Gordon's time inconsistency framework (1983; 1983). They note that, when unanticipated changes in monetary policy can stimulate output, governments are unable to credibly commit to low inflation. Delegating policy to an institution which is less inflation-tolerant than the government is often seen as a way to limit this problem (Rogoff 1985); consistent literature finds a negative correlation between measures of legal CBI and inflation outcomes across countries (e.g., Alesina and Summers 1993; Arnone et al. 2009).

Others have questioned the logic of monetary delegation by noting that legal independence does not necessarily imply de facto autonomy (e.g., McCallum 1995; Posen 1995; Mishkin 2004). In particular, central bank laws can be circumvented by de facto procedures or implicit political pressures (Broz 2002; Acemoglu et al. 2008; Alesina and Stella 2010). Thus, even if the public can observe the amount legal independence granted to monetary authorities, it may be unclear how de jure autonomy translates into actual control over policy. In such circumstances, there may be uncertainties concerning policymakers' preferences towards inflation (e.g., Canzoneri 1985; Drazen 2000, ch. 6). This may limit the impact of monetary delegation. Accordingly, existing empirical studies show that correlation between CBI and inflation is not always robust to the use of statistical controls (Campillo and Miron 1997; Oatley 1999) or country fixed effects (Crowe and Meade 2008); moreover, results tend to be much weaker in developing countries (e.g., Cukierman, Miller, and Neyapti 2002; Garriga 2016).

I contribute to this literature by studying how communication policy eases monitoring problems involved in central bank delegation. This approach differs from commitment mechanisms studied in previous contributions, which include the role political institutions (Acemoglu et al. 2008; Bodea and Hicks 2015) and the possibility to take actions that signal a low level inflation tolerance (e.g., Barro and Gordon 1983b; Backus and Driffill 1985; Hansen and McMahon 2016a). While I do not contest the importance

[2] In the robustness tests, I also show that main the results are still valid when inflation targeting is used as an alternative proxy for transparency.

of these factors, I still argue that transparency offers a useful commitment device to promote policymakers' reputation. Supporting this view, I show that accounting for the interactions between communication and independence helps to explain variations in inflation outcomes within a large set of countries, even including several controls and focusing on emerging markets. I also find that CBI without transparency does not have any impact on inflation. In this respect, accounting for variations in communication policy appears important for the study of monetary delegation more broadly.

4.2 Theoretical framework

To organise the data, I consider a theory which allows to study potential complementarities between monetary delegation and transparency. The aim of the framework, which is highly stylised, is to derive testable implications for the impact of communication on the ability of monetary authorities to control inflation. Below I start by outlining the model's setting; I then consider the key dynamics and related empirical predictions before briefly discussing some of the assumptions.

I consider a game between a monetary authority (the central bank, CB) and the public (or private sector). At the beginning of the game, the CB observes the realisation of a state of the world variable $u \in \mathbb{R}$ and a preference shock $\theta \in \mathbb{R}$, which affects policymakers' inflation tolerance. Next, the central bank chooses the value of a monetary instrument $m \in \mathbb{R}$ and chooses a level of transparency $\tau \in \{H, L\}$ over the variable u, where the notation indicates high (H) or low (L) levels of transparency. The public observes m (but not directly u or θ) and forms expectations concerning inflation. Inflation and output in the economy are then defined according to:

$$\pi = m - u \tag{4.1}$$

$$y = \pi - \pi^E, \tag{4.2}$$

where $\pi^E \equiv E[\pi|i]$ is the value of inflation expected by the private sector and equation (4.2) follows from an expectation augmented Phillips curve with potential output equal to zero. The state of the world variable u summarises central banks' knowledge (data, forecasts, targets) of how the monetary instrument maps into the economy, representing the different information that monetary authorities can use to formulate policy. I assume the public has imperfect knowledge concerning this information; specifically, let

u be normally distributed with mean μ_u and variance σ_u^2, i.e. $u \sim \mathcal{N}(\mu_u, \sigma_u^2)$ (Faust and Svensson 2001). As explained shortly, the communication policy τ affects the precision with which the public sector observes this variable.

The problem for the public is to anticipate the level of inflation after observing the central bank's policy decision m. In line with the literature, the private sector is only interested in forming correct inflation expectations (e.g., Persson and Tabellini 2012: 8-9). The central bank's payoffs involve instead a trade-off between controlling inflation and stimulating the economy (Barro and Gordon 1983a; Frankel and Kartik 2015):

$$U_{CB} = -\frac{1}{2}\pi^2 + \gamma y. \tag{4.3}$$

Equation (4.3) captures both the losses arising from the deviation of inflation for its target, here set to zero,[3] and the gains from stimulating output. The parameter γ represents preferences over the output gap, constituting a measure of policymakers' inflation tolerance (Hansen and McMahon 2016a). As in the CBI literature, I interpret this variable as policymakers' *de facto* autonomy; a highly independent central bank (low γ) attaches low weight to stimulating output beyond its non-inflationary level (Laurens, Arnone, and Segalotto 2016).

In this paper, I mostly assume that inflation tolerance is private information, namely, that the public has imperfect knowledge of policymakers' actual autonomy. The public observes the level of legal CBI, but it is uncertain to what extent formal delegation translates in de facto control over policy. In a simple way, this captures potential difficulties that the private sector encounters in measuring the de facto independence of policymakers (Mishkin 2004; Alesina and Stella 2010). Formally, I assume inflation tolerance γ to be the result of two variables. The first dimension is the level of legal CBI, represented by the parameter $\alpha \in [0, 1]$, which is observable by the private sector. The second component is captured by the preference shock θ, not directly known by the public. Policymakers' inflation tolerance is then given by:

$$\gamma = (1 - \alpha) + \theta, \tag{4.4}$$

where θ is a random variable normally distributed normally with mean $\mu_\theta > 0$ and variance σ_θ^2, i.e. $\theta \sim \mathcal{N}(\mu_\theta, \sigma_\theta^2)$. Equation (4.4) implies that inflation tolerance de-

[3]This assumption is further discussed in section 4.2.2.

creases with legal independence α and increases with the unobserved preference component θ.

The transparency of communication policy τ, in turn, relates to the ability of the public to understand policymakers's intentions (Faust and Svensson 2001). In this framework, the private sector is uncertain about the central bank's de facto autonomy as well as about how observed decisions map into inflation. In the latter case, uncertainty is determined by imperfect knowledge over the state variable u. A higher (lower) variance of this variable makes it more (less) difficult for the public to discern central banks' intentions from the observed policy action. By lowering the noise about policy decisions, the central bank can reduce uncertainty concerning its actions. Building on this intuition, I capture central bank transparency as the (inverse of the) variance of u (Geraats 2002; Frankel and Kartik 2015). For this, let $\sigma^2_{u,\tau}$ denote the variance of the private sector's belief about the state variable under communication policy τ. I make the following assumption:

$$0 < \sigma^2_{u,H} < \sigma^2_{u,L}, \tag{4.5}$$

which implies that the private sector can better understand policy outcomes when monetary authorities choose a high transparency policy $\tau = H$.

This definition is fairly general, and it arguably captures most variations in communication policy observed in practice. One example of increased transparency is constituted by the timely release of monetary statements explaining policy actions, which implies the public has greater information concerning policymakers' decisions (Faust and Svensson 2001). Similarly, the publication of meeting minutes and inflation reports should make it easier for the public to deduce central banks' intentions from their observed decisions (Eichengreen and Dincer 2014). The case of inflation targeting is partially different, as it is normally understood in terms of the objectives of the central bank as represented by equation (4.3) above (e.g., Svensson 1997b). Nevertheless, to the extent that a target clarifies central banks' intentions for inflation, it may also imply a reduction of uncertainty in line with condition (4.5).[4] I further consider these issues in section 4.3.1, where I describe the measure used to operationalise the definition of transparency expressed in condition (4.5).

[4]For a similar interpretation, see for example Bernanke et al. (1999) and Dincer and Eichengreen (2007). The specific case of inflation targeting is briefly discussed as an extension in section 4.2.2 and addressed empirically in section 4.4.

The timing of the game is as follow:

0. Nature draws the state of the world variable u and the preference shock θ.
1. The central bank observes u and θ, chooses the monetary instrument m and decides on the level of transparency τ.
2. The public observes m and derives inflation expectations π^E.
3. Inflation π, output y are realised and the game ends.

All aspects of the game, apart from the state variable u and the preference shock θ, are common knowledge. To derive testable implications, below I focus on Perfect Bayesian equilibria in pure strategies. In this framework, these can be defined by the central bank's strategy over τ and m, when the public's beliefs π^E are formed using Bayes rule (Frankel and Kartik 2015).

4.2.1 Results and dynamics

The assumptions about the timing imply that the public observes the central bank's decision before forming expectations about its likely impact on inflation. I follow Frankel and Kartik (2015; 2018) and assume the public uses a linear conjecture concerning inflation:

$$E[u|m] = k_1 m + k_0, \tag{4.6}$$
$$E[\pi|m] = m - E[u|m] = (1 - k_1)m - k_0, \tag{4.7}$$

where k_0 and k_1 are parameters to be determined.

Using the central bank's payoff function (4.3) and the associated conditions for equilibrium (see Appendix 4.A.1 for details) we can substitute the value for inflation $\pi = m - u$, output $\pi - \pi^E$ and the expression for expected inflation given in (4.7) to obtain the CB's choice of the policy instrument m for realised values of u and γ:

$$m(u, \gamma) = \gamma k_1 + u = (1 - \alpha + \theta)k_1 + u \tag{4.8}$$

It follows from Equation (4.8) and the assumption of normality on u and θ that, upon observing the value of the monetary instrument, the public's posterior expected value of the policy variable u is given by:

$$E[u|m] = \frac{\sigma_u^2}{\sigma_u^2 + k_1^2\sigma_\theta^2}m + \mu_u - \frac{\sigma_u^2}{\sigma_u^2 + k_1^2\sigma_\theta^2}\Big((1 - \alpha + \mu_\theta)k_1 + \mu_u\Big). \tag{4.9}$$

The public's posterior in (4.9) has the same linear form of the conjecture expressed in (4.6), which implies that the beliefs of the private sector are consistent with the CB's behaviour. Requesting that the coefficients in (4.6) and (4.9) are equal, in equilibrium k_1 must solve:

$$k_1 = \frac{\sigma_u^2}{\sigma_u^2 + k_1^2\sigma_\theta^2} \tag{4.10}$$

Define k^* the solution to Equation (4.10).[5] It is now possible to derive realised values for inflation and output in the economy:

$$\pi = \gamma k^* = (1 - \alpha + \theta)k^*; \tag{4.11}$$

$$y = k^*\Big(k^*(\theta - \mu_\theta) + (\mu_u - u)\Big) + (\mu_u - u). \tag{4.12}$$

Equation (4.11) implies that inflation π depends on two factors. First of all, it is a function of the level of policymakers' de facto autonomy: in particular, lower γ is associated with lower inflation. Secondly, prices depend on the public's ability to anticipate the intended outcomes of central banks' decisions, here captured by the parameter k^*. Equation (4.12), in turn, indicates that average output equals its potential levels as the public correctly anticipates inflation. A central bank which has an inflation tolerance higher than anticipated ($\theta > \mu_\theta$) may succeed in stimulating growth at the price of greater inflation (cf. Geraats 2007); similarly, a value of u which is lower than anticipated implies higher inflation and higher output. In both cases, however, this "surprise" effect decreases if the updating coefficient k^* becomes lower.

The role of transparency in promoting credibility is a result of these dynamics. Using equation (4.10) it can be shown that the size of k^* depends positively on the level of uncertainty concerning the central bank's information u.[6] By opting for a high transparency communication policy $\tau = H$, monetary authorities can reduce uncertainty concerning their decisions. This limits the possibility of using policy to stimulate the

[5] In Appendix 4.A.1, it is shown that equation (4.10) has a unique real solution comprised between 0 and 1, as implied by equation (4.7).

[6] A formal proof is again given in Appendix 4.A.1.

economy and helps policymakers to commit to the desired inflation level (Dincer and Eichengreen 2007). Using the expressions for realised inflation and output reported in (4.11) and (4.12), it is possible to write the CB's payoffs as:

$$U_{CB} = -\frac{1}{2}(\gamma k^*)^2 + \gamma\Big((k^*)^2(\theta - \mu_\theta) + k^*(\mu_u - u) + \mu_u - u\Big). \tag{4.13}$$

Greater transparency (lower k^*) reduces losses arising from high inflation, while limiting gains from output expansion. As a consequence, the extent to which monetary authorities are willing to adopt greater communication depends also on their level of inflation tolerance. Low independence (high θ) should make a high transparency policy $\tau = H$ unattractive, given the lower chances to stimulate the economy when the public has a good understanding of the impact of policy decisions. Yet if the central bank enjoys a high level of de facto autonomy (θ is low), shifting to greater disclosure can be helpful to reduce inflation expectations. Proposition 1 summarises this reasoning.

Proposition 1. *Consider the case in which the public forms linear expectations according to (4.6) and (4.7). There exist values of $\sigma_u^2(H), \sigma_u^2(L)$ and $\bar{\theta}$ such that, in equilibrium, the central bank chooses greater transparency $\tau = H$ if $\theta < \bar{\theta}$. Under this strategy, the central bank's policy satisfies (4.8). In this equilibrium:*

- *Realised inflation and output are given respectively by (4.11) and (4.12).*
- *Inflation is lower if the central bank opts for a high transparency communication policy $\tau = H$.*

(Proof: see Appendix 4.A.1).

The main implication is that, when the public is uncertain about the level of policymakers' de facto autonomy, transparency matters for monetary authorities' ability to control inflation. An increase in the amount of information provided to the public favours understanding of policymakers' decisions and help the central bank to use policy to manage expectations. Assuming that the central bank's payoffs can be described as in equation (4.3), we should observe lower inflation in response to an increase in transparency. This intuition constitutes the first research hypothesis tested below.

In addition, the model predicts that this effect depends positively on the level of observed legal autonomy α. As shown in equation (4.11), inflation in the economy is a

result of both policymakers' legal autonomy and the ability of the public to infer policymakers' intentions. Given that the public observes the level of legal CBI and uses it to form inflation expectations, we can expect delegation and communication to interact. While legal arrangements shift the public's ex-ante concerning policymakers' inflation tolerance, communication helps delegated central banks to demonstrate their commitment to price stability. In this case, we can expect the impact of high transparency to be stronger (and inflation lower) for high levels of CBI. This argument can be summarised as follows:

Proposition 2. *Assume that Proposition 1 holds and $\theta < \bar{\theta}$. Realised inflation in response to high transparency $\tau = H$ is lower for high levels of legal autonomy α.*
(Proof: see Appendix 4.A.2).

Proposition 2 suggests that, while inflation is lower under a policy of high transparency, this effect is mediated by pre-existing levels of CBI. As a result, the impact of an increase in transparency on credibility is reinforced by the institutional environment. This reasoning, which suggests strong complementarities between CBI and transparency, constitutes the second hypothesis tested below.

It is also interesting to note the framework suggests different reasons why legal independence *without* transparency might fail to have any impact on prices. In the model, this can be the result of two effects. First of all, as noted, the impact of CBI on expectations is itself mediated by the public's understanding of central banks' decision; hence, a high level of legal autonomy might result ineffective if the transparency of policymakers' actions is low. In addition, Proposition 1 suggests that whenever policymakers are committed to controlling inflation, they should always opt for additional communication $\tau = H$. Hence low transparency, even in the presence of high legal independence, might imply low de facto autonomy and high inflation tolerance. In both cases, an increase in legal CBI without a shift towards greater openness might have limited effect on prices. I further evaluate these arguments in Section 4.4.2, where I extend the empirical analysis to examine individual effects of CBI and central bank transparency.

4.2.2 Discussion and alternative hypotheses

Before describing the empirical approach used to test propositions 1 and 2, it is useful to briefly discuss some of the assumptions underlying the model to distinguish its

implications from alternative theories.[7]

First of all, I have assumed that the level of de facto autonomy (policymakers' inflation tolerance) is imperfectly known by the public. If instead the private sector could observe this policy dimension, it would use it to derive the value of the state of the world variable u. In this case, the resulting value for inflation would be γ and transparency would not influence expectations. Under this alternative assumption, inflation would only be affected by legal autonomy, as in the CBI literature. An implication is that inflation should not change in response to a shift in communication policy.[8] I take this possibility as a null hypothesis against which evaluate the role of transparency outlined above.

In addition, I have assumed that the public observes the policy decision m before forming expectations. This implies that, when setting policy, the central bank takes into account the impact of the monetary instrument on expectations. If instead the public were only allowed to form expectations before the central bank sets policy, as in Barro and Gordon's (1983) model, monetary authorities would set policy taking expectations as given. In this case, realised inflation would be exclusively a function of the level of inflation tolerance anticipated by the public.[9] Again, we should not see any variations in price dynamics following changes in transparency.

Another assumption, summarised in condition (4.5), is that greater central bank transparency $\tau = H$ increases the public's understanding of policymakers' decisions. In practice, this might not be the case (Blinder, Goodhart, and Wiplosz 2001; Winkler 2002). For example, it has been noted that excessive disclosures may raise noise surrounding policymakers' objectives (Dale, Orphanides, and Osterholmc 2011; Blinder, Ehrmann, et al. 2008), or induce the public to pay excessive attention to central banks' messages and overlook private information (Geraats 2002; Morris and Shin 2002; Morris, Shin, and H. Tong 2006).[10] While these potential drawbacks may limit policymakers' willingness to adopt greater communication, the framework above suggests that transparency can also have positive effects on credibility. These opposing arguments are analysed empirically in the next section.

[7]Further analysis of the model's assumption is reported in appendix 4.B.

[8]The proof is reported in appendix 4.B.1.

[9]The proof is reported in 4.B.2.

[10]An additional potential of transparency is that it may damage policymakers' reputation, by making it easier for external observers to identify potential mistakes (Meade and Stasavage 2008; Schonhardt-Bailey 2013; Hansen, McMahon, and Prat 2018).

Finally, in the model the private sector directly observes the central banks' target for inflation; in equation (4.3), this target is set to zero. We would obtain similar results in the more realistic case where, as in most inflation-targeting (IT) regimes, monetary authorities adopt a positive target $\pi^* > 0$ (e.g., Svensson 1997a).[11] However, in practice the public might not be able to directly observe central banks' inflation targets, especially given that several economies do not officially adopt an IT regime (Roger 2009). This raises the question whether the theoretical results depend on a perfectly observable target. I explore this possibility in section 4.4.2, where I use the adoption of IT as an alternative proxy for transparency. As further discussed below, I find some correlation between the adoption of an explicit target and inflation outcomes (conditional on CBI). At the same time, the estimates also suggest that results are not driven only by these observations, suggesting that the assumption is not necessary for the above results.

4.3 Empirical analysis

The theoretical framework has two main empirical predictions. The first is that an increase in central bank transparency should be followed by a decline in inflation; the second is that such a decline should be relatively stronger for high levels of CBI. In this section, I describe the data sources and empirical approach used to test these expectations.

4.3.1 Data

Central bank transparency and reforms

An important challenge in testing the research hypotheses relates to the measurement of central bank transparency. To this aim, I adapt the de jure index of transparency developed by Dincer and Eichengreen (2007; 2009; 2014). The authors use information from central banks' published documents (websites, statutes and annual reports) to derive a 0-15 scale of transparency, across multiple policy dimensions, where higher values indicate greater disclosure.

The indicator extends previous classifications of central bank transparency developed by Geerats (2002; 2009) and Eijiffinger and Geraats (2006). With respect to these studies, the Dincer-Eichengreen indicator has the advantage of providing the largest

[11] See 4.B.3 for details.

country and time coverage of communication policy.[12] As in previous contributions, the authors emphasise five aspects of monetary communication, namely political, economic, procedural, policy and operational transparency.[13] The authors collect and weight information on each of these dimensions for 120 central banks in the period from 1998 to 2010; for each country, resulting measures are aggregated at the annual frequency, using the values that prevails in the longest part of the year.[14] Data availability on key covariates (discussed below) reduces the sample to 95 countries, listed in appendix 4.D.

Starting from this measure, I capture reforms in central bank transparency as large annual changes in the Dincer-Eichengreen indicator. My approach is consistent with recent work on capital mobility conducted by Furceri, Loungani, and Ostry (2019). Specifically, I identify reforms in communication as positive changes in the Dincer-Eichengreen indicator of transparency, exceeding two standard deviations the annual change for each country. I then code the resulting variable as a binary indicator *Transp. (Reform)* taking the value of 1 in the year of an increase in transparency and 0 otherwise. As further explained below, this constitute the main variable for changes in transparency used in the analysis. Using this approach, I identify 78 episodes of changes in communication in the sample, which have taken place both in industrialised economies (e.g., Australia, Norway, and the Unites States) and emerging markets (e.g., Brazil, Colombia, the Philippines). Appendix 4.D reports the lists the set of reforms used in the study. For each country, appendix 4.D reports also the average value of the Dincer-Eichengreen indicator in the sample period.

Central bank independence

To assess whether the impact of a change in transparency depends on pre-existing levels of legal autonomy, I use the CBI dataset developed by Garriga (2016). This is an annual 0 to 1 index taking higher values if the central bank is more legally independent. The measure builds on a previous classification by Cukierman, Web, and

[12] These criteria are similar to those used in other studies by Crowe and Meade (2008) and Siklos (2011), although these alternative indicators have lower country and year coverage.

[13] Political transparency denotes communication about objectives of policy decisions; economic transparency openness about data, including models and forecasts, used in the decision-making process; procedural transparency communication about the process of deliberation internal to the central bank; policy transparency openness about potential implications of monetary decisions; and operational transparency openness concerning the implementation of central banks' policies. Appendix 4.C reports a full description of the index.

[14] A full description of the criteria used to measure each component of the index, including the weighting scheme, is reported in appendix 4.C.

Neyapti (1992). It is based on legal provisions on central bank autonomy and contains information about three relevant dimensions of CBI: legal restrictions on governments' influence over the term limits of central banks' officials; limitations to the possibility of public debt financing; and legal guarantees on policymakers' freedom to formulate and execute monetary policy. With respect to different indicators of CBI (Crowe and Meade 2008; Bodea and Hicks 2015), this measure has the advantage of covering a larger number of countries, particularly among emerging markets.

An important aspect of this indicator is that, by focusing on changes in central bank statute, it does not vary in those cases in which changes in communication have not been accompanied by changes in the legal mandate of monetary authorities. As a result, it should generally be possible to use this index in interaction with the measure of central bank transparency, as further discussed below. Specifically, none of the discrete in communication identified in this study have taken place in the same year of a change in legal autonomy. This indicates that, consistent with the theory presented above, most increases in transparency have been driven by policymakers themselves.[15] To further investigate this point, below I also describe estimates obtained for a smaller sample that excludes all countries in which transparency and independence have changed within the same year at least once.[16] Doing so should allow focus attention on those cases in which variations in communication have been primarily driven by central banks themselves, providing additional support for the research hypotheses.

Control variables

As explained in the next section, in this study I rely mainly on short-term changes in inflation to identify the impact of communication on credibility. Nonetheless, I also include various controls to account for alternative drivers of inflation outcomes. First of all, I control for the state's exchange rate regime, include lagged values of de facto exchange rate flexibility (Ilzetzki, Reinhart, and Rogoff 2017). To account for economic openness, I include the lagged share of import/exports of GDP (Eichengreen and Dincer 2014). To control for economic development (Broz 2002; Bodea and Hicks 2015), I

[15]More broadly, simultaneous changes in the Dincer-Eichengreen measure of transparency and proxies for CBI policy are rare in the dataset. This suggests that most variations in transparency are driven by policymakers themselves. Of all annual changes in transparency registered by the Dincer-Eichengreen indicator, about 10% took place in the same year as variations in central bank statute. As noted, however, none of the main reforms in transparency have taken place in the same year.

[16]Note that this approach drops not only the year in which the change took place, but also all subsequent and previous years within the same country.

add lagged values for the logarithm of a GDP, as well as lagged GDP growth. Finally, I control for lagged government deficit to account for the state's fiscal position. In the robustness checks, I also consider controls for democracy and political checks and balances, which previous contributions have shown to be important drivers of transparency and CBI (Crowe and Meade 2008; Eichengreen and Dincer 2014).

4.3.2 Statistical approach

To assess the impact of an increase in transparency on inflation, I start by estimating the following model:

$$\pi_{i,t} = \eta_i + \delta_t + \beta_1 \text{Transp.}(\text{Reform})_{i,t} + X_{i,t-1} z' + \phi \pi_{i,t-1} + \varepsilon_{i,t} \tag{4.14}$$

where $\pi_{n,t}$ is the logarithm of CPI inflation for country i in year t; *Transp. (Reform)*$_{i,t}$ is the binary index taking the value of 1 in the case of a discrete increase in central bank transparency in country i at year t, as discussed above; η_i and δ_t are country- and year fixed effects; $\pi_{i,t-1}$ is the one-year lag in CPI, accounting for persistence in inflation; and $X_{i,t-1}$ are the set of lagged time-varying controls.

Specification (4.14) compares inflation outcomes within country in years in which central banks have adopted greater transparency, as opposed to all other years. By doing so, the model limits the measurement of the impact of transparency to the period immediately subsequent to a reform in transparency. This approach has the advantage of reducing the influence of unobserved factors which might drive long-term inflation outcomes. It excludes any variable which might correlate with both communication policy and inflation over the long run, but that does not change in years in which monetary authorities have greater transparency. The effect of interest is captured by the difference in differences estimator β_1, which measures the impact of an increase in transparency at time t. Following Proposition 1, I anticipate this coefficient to be negative.

The theoretical discussion also suggests that, to the extent additional communication helps monetary authorities to control inflation, the effect of transparency should be stronger when the central bank has greater institutional independence. Therefore, I complement specification (4.14) with the following model:

$$\begin{aligned}\pi_{i,t} =&\eta_i + \delta_t + \\ &+ \beta_1 \text{Transp.(Reform)}_{i,t} + \beta_2 \text{CBI}_{i,t} + \beta_3 (\text{Transp.(Reform)}_{i,t} \times \text{CBI}_{i,t}) + \\ &+ X_{i,t-1} z' + \phi \pi_{i,t-1} + \varepsilon_{i,t}\end{aligned} \tag{4.15}$$

where $CBI_{i,t}$ is the value of the Garriga index of central bank autonomy for country i in year t. Specification (4.15) compares inflation outcomes following discrete increases in transparency, for different levels of CBI; this should provide a direct test concerning complementarities between communication policy and legal autonomy. The coefficient of interest is given by β_3 which, following the theoretical discussion, I expect to be negative. As noted above, in the sample variations in transparency did not take place in the same year of changes in central bank statutes, so that it is possible to interpret β_3 as the conditional impact of communication on inflation.

The main assumption underlying models (4.14) and (4.15) is that, in absence of reforms in communication policy, price dynamics would not differ significantly among countries (e.g., Goodman-Bacon 2018). Tests for this assumption are reported directly in the next section. Below, I also discuss further sensitivity checks which include additional samples; proxies for transparency; time trends; and controls. For the main estimates, I use both OLS and GMM estimators, to account for bias in least squares estimators related to the use of lagged values of CPI inflation in the statistical models (e.g., Arellano and Bond 1991; Bond 2002; Croissant, Millo, et al. 2008). Error terms $\varepsilon_{i,t}$ are clustered at the country level to account for serial correlation within units.

4.4 Results

4.4.1 Main results

Table 4.1 reports results obtained fitting specification (4.14) on the full dataset, therefore focusing on the individual effects of discrete increases in transparency. As shown, there is a negative and significant correlation between the indicator for a reform in transparency and annual inflation. This implies that in years in which monetary authorities have opted for an increase in disclosure, inflation in the country has decreased. This ef-

fect is robust to the use of the different time-varying controls and estimators; moreover, the negative correlation becomes strongly significant when GMM estimators are used to estimate regression coefficients.[17] The coefficient of the indicator on transparency remains broadly stable across models, thus supporting the key argument concerning the impact of communication on credibility.

Estimates reported in table 4.1 also suggest that this effect substantial. For example, taking estimates in column 2 of table 4.1 as reference and recalling that the dependent variable is expressed in logarithmic scale, inflation results being on average one fifth (roughly 20%) lower in years in which central banks' communication policies have become more open. This relatively large impact reinforces the idea that transparency affects the ability of monetary authorities to manage expectations.

As noted, a causal interpretation of these results relies on the assumption that trends in inflation would not change in absence of reforms in transparency. As an indirect test for this assumption, in column 5 of table 4.1 I augment the main specification with two additional regressors capturing one and three-years lags with respect to a reform in transparency. To the extent that changes in inflation identified in columns 1 to 4 of table 4.1 are actually driven by variations in communication policy, we should not find any significant effect for these additional variables. Supporting this view, the coefficients on these additional regressors are not statistically insignificant; this indicates that the only systematic change in inflation corresponds to years of reforms in communication.

In this additional model, I find a negative (but insignificant) negative correlation in the case of the one-year lag in the transparency reform indicator. This can be due to multiple factors, including problems in identifying changes in transparency,[18] or to the fact central banks sometimes may adopt greater transparency as a way to "lock-in" previous decreases in inflation (Blinder, Ehrmann, et al. 2008). Irrespectively, the results indicate that changes in inflation dynamics take place in response to variations in communication, therefore supporting the empirical approach.

Next, I turn to the analysis of the mediating effects of CBI, thus focusing on specification (4.15). In table 4.2, I include the Garriga index of central bank legal autonomy and I interact it with the binary indicators for reforms transparency. As shown, the in-

[17] This effect is likely to be due to the relatively short timespan used for the analysis. As noted in Arellano and Bond (1991), biases in OLS estimates in dynamic panel settings can be severe when few time periods are available in the analysis, as in this study.

[18] As noted, the Dincer-Eichengreen indicator only captures a variation in communication policy if it has been in place for half a year or longer.

Table 4.1: Effect of discrete changes in transparency on inflation

	Log of annual CPI inflation				
	OLS	*OLS*	*GMM*	*GMM*	*GMM*
	(1)	(2)	(3)	(4)	(5)
Transparency reform (t)	-0.192^{*}	-0.213^{**}	-0.280^{**}	-0.290^{**}	-0.357^{**}
	(0.099)	(0.101)	(0.125)	(0.124)	(0.141)
Transparency reform ($t-1$)					-0.115
					(0.089)
Transparency reform ($t-3$)					-0.043
					(0.096)
CPI inflation ($t-1$)	0.243^{***}	0.215^{***}	0.396^{***}	0.371^{***}	0.409^{***}
	(0.046)	(0.042)	(0.060)	(0.070)	(0.100)
Controls		Yes		Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	876	876	876	876	876
No. of groups	95	95	95	95	95
R^2 (within)	0.211	0.233			
F Statistic	15.844	12.893			
Sargan test			67.838	73.164	72.816
Wald test			50.708	67.198	80.471

Note: *p<0.1; **p<0.05; ***p<0.01

Transparency reform is equal to 1 in years in which the Dincer-Eichengreen indicator exceeds 2 standard deviations the average annual change for the country, and 0 otherwise. Control variables are lagged values of: (i) de facto exchange rate flexibility; (ii) import-export as share of GDP (iii) GDP growth (iv) logarithm of GDP per capita; (v) fiscal deficit. Standard errors clustered by country are reported in parentheses.

teraction effect is negative and statistically significant. The relevant coefficients remain broadly stable across models, even after including statistical controls; moreover, the level of statistical significance for this regressor is again higher in the case of GMM estimates. In line with expectations, it appears that a high level of autonomy reinforces the effects of changes in communication.

To interpret these findings, in figure 4.1 I derive estimated effects of a discrete increase in central bank openness (Transparency reform $(t) = 1$) for different levels of the Garriga index of CBI, using using estimates reported in column 2 of table 4.1 as reference. Figure 4.1 focuses on values of CBI ranging from 0.1 to 0.7, corresponding to one standard deviation below and above the sample average for central bank autonomy (0.4). As expected, an increase in transparency appears to be associated with lower inflation. However, this effect is stronger for relatively high levels of legal autonomy. For example, a reform in transparency is associated with approximately a one third decrease in inflation ($p < 0.05$) for a CBI index of 0.7, as opposed to a non-significant decline of less than 7% ($p > 0.1$) in the case of level of a 0.4 value of the Garriga indicator. This difference confirms the importance of CBI as a mediating factor for transparency.

In column 5 of of table 4.2, I study whether this effect is driven by changes in inflation prior to changes in communication policy. As for the previous tests, I augment the model with lagged indicators for reforms in transparency, together with their interaction with CBI, to verify the absence of contemporaneous changes in inflation. Again, I find no statistically significant effects for the lagged variables. While the level of statistical significance for the coefficient on the key interaction effect is marginally lower in column 5, the size of the coefficient is consistent with those reported for the other models and much larger than the one obtained for the interaction at $t - 1$. Together, these sensitivity checks suggest that the estimates reported in table 4.2 actually capture responses to changes in transparency, increasing the robustness of the findings.

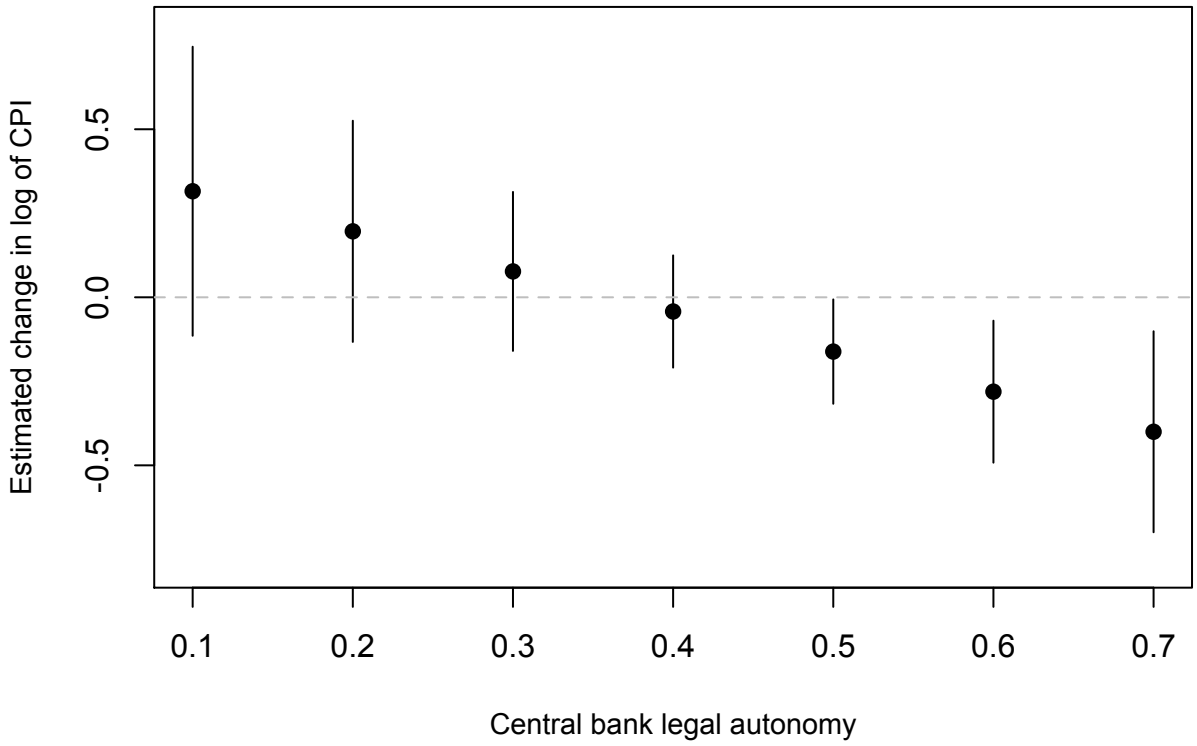
It is interesting to note that, when the interaction effect is added to the analysis, individual coefficients for reforms in transparency become positive and mostly not significant. This result, which accords with Proposition 2, reinforces the idea that impact of communication on inflation is mediated by pre-existing levels of CBI. In line with expectations, it appears that an institutional framework which grants autonomy to the central bank appears to add credibility to policymakers' announcements. Similarly, the individual coefficients for CBI reported in table 4.2 are not statistically significant. This implies that the effect of independence on inflation is mediated by central banks'

Table 4.2: Effect of discrete changes in transparency on inflation, conditional on CBI

	Log of annual CPI inflation				
	OLS	*OLS*	*GMM*	*GMM*	*GMM*
	(1)	(2)	(3)	(4)	(5)
Transparency reform (t)	0.334	0.342	0.619*	0.619*	0.781
	(0.291)	(0.298)	(0.324)	(0.323)	(0.574)
Transparency reform ($t-1$)					0.419
					(0.935)
Transparency reform ($t-3$)					−0.908
					(0.890)
CBI	0.093	−0.024	−0.053	−0.066	−0.180
	(0.528)	(0.513)	(0.360)	(0.346)	(0.499)
Transparency reform (t) × CBI	−0.963*	−1.015*	−1.625**	−1.647**	−2.011*
	(0.585)	(0.595)	(0.712)	(0.712)	(1.150)
Transparency reform ($t-1$) × CBI					−0.933
					(1.643)
Transparency reform ($t-3$) × CBI					1.530
					(1.588)
CPI inflation ($t-1$)	0.248***	0.218***	0.405***	0.380***	0.402***
	(0.291)	(0.298)	(0.060)	(0.071)	(0.107)
Controls		Yes		Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	876	876	876	876	876
No. of groups	95	95	95	95	95
R^2 (within)	0.217	0.240			
F Statistic	14.166	11.985			
Sargan test			73.164	72.816	69.806
Wald test			67.198	80.471	80.713
Note:					*p<0.1; **p<0.05; ***p<0.01

Transparency reform is equal to 1 in years in which the Dincer-Eichengreen indicator exceeds 2 standard deviations the average annual change for the country, and 0 otherwise. Control variables are lagged values of: (i) de facto exchange rate flexibility; (ii) import-export as share of GDP (iii) GDP growth (iv) logarithm of GDP per capita; (v) fiscal deficit. Standard errors clustered by country reported in parentheses.

Figure 4.1: Estimated effect of a discrete increase in transparency, by CBI



Estimated change in the logarithm of CPI inflation in response to reforms in communication policy (Transparency reform (t) = 1), conditional on central bank legal independence (Garriga index). Estimates are obtained from column 2 of table 4.2. Control variables are left at their mean values. The bars indicate 95% confidence intervals, obtained using clustered standard errors.

communication policy. The result is consistent with the theoretical discussion, which suggests that legal autonomy without transparency may have limited effects on inflation. I consider this finding in greater detail in the next section.

In summary, the empirical analysis suggests that communication policy helps delegated monetary authorities in controlling inflation. In line with expectations, inflation results being lower in response to an increase in transparency; moreover, this effect is stronger when ex-ante legal CBI is higher. In contrast, transparency or independence in isolation appear to have limited impact on prices. The effects are robust to different estimators, controls, and they are not driven by changes in inflation dynamics prior to the introduction of reforms in communication, supporting the idea of policy complementarities between transparency and delegation.

4.4.2 Robustness and extensions

Building on the above results, I now describe additional tests to refine the analysis and relate it to the broader literature. Following the discussion in sections 4.1 and 4.2, I specifically focus on inflation targeting, the individual effect of CBI, and the analysis of emerging markets. Additional robustness checks are outlined below and included in the appendix.

Inflation targeting. As noted in section 4.2, it is interesting to examine whether the main results are driven by country's adoption of an explicit inflation targeting (IT) regime. For this, I build on the classification of IT economies provided by Roger (2009) and Hammond (2012) to construct an additional binary variable, taking the value of 1 in the year in which monetary authorities have shifted to a formal inflation-targeting regime, and 0 in all other years. I then use this additional variable as an alternative proxy for transparency to repeat the main estimates in tables 4.1 and 4.2.

OLS results obtained for the additional models are reported in appendix 4.F. As shown, the coefficient for IT adoption not significant when taken in isolation; however, I find a negative and significant interaction effect between this variable and CBI. I draw two conclusions. First, insignificant coefficients for IT suggest that the effects of transparency reported in tables 4.1 and 4.2 do not exclusively depend on the adoption of an inflation targeting regime. Second, as in the case of broader forms of communication it appears that the effect of IT adoption is conditional on CBI. This finding accords with contributions suggesting that legal independence is an important condition for the

success of inflation targeting (e.g., Mishkin and Jonas 2003; Mishkin 2004; Batini and Laxton 2006; Al-Mashat et al. 2018b).

Individual effects of CBI. An additional aspect of the analysis concerns the individual effects of central bank independence on inflation. The model presented in section 4.2 indicates that, in the absence of a transparent communication policy, an increase in legal autonomy might fail to increase the credibility of central banks' commitments. This intuition is supported by results in table 4.2 above, which suggest the correlation between CBI and inflation is mediated by authorities' communication policy.

In appendix 4.G, I further investigate this issue by replicating the key results using CBI and transparency variables in isolation, thus excluding their interaction. In line with previous results, I do not find any significant correlation between the Garriga index of central bank autonomy and inflation; this is true both including and excluding controls. Moreover, when the indicator for transparency is added to the models, it remains significant, while the CBI variable is not; this suggests that communication has a relatively stronger impact on inflation than independence. The main implication is that, as suggested in the theoretical discussion, the effectiveness of reforms in central banks' autonomy depends also on transparency. In the absence of an open communication policy, the impact of legal autonomy on credibility appears to be limited.

Emerging markets. As noted in section 4.1, previous research finds that the impact of monetary delegation is weaker in emerging markets than in industrialised economies (e.g., Cukierman, Web, and Neyapti 1992). This raises the possibility that the above results are driven by high income countries.[19] To account for this possibility, I repeat the analysis using dropping all countries classified as 'high income' by the World Bank Country and Lending Groups classification,[20] deriving least squares estimates for the impact of transparency and its interaction with CBI in this alternative sample.

Relevant estimates are reported in appendix 4.E. As shown, the relevant coefficients on reforms in transparency remain negative and significant, even after introducing the controls and especially when interacted with CBI. These results demonstrate that the

[19] Similarly, existing contributions find that monetary authorities operating in industrialised economies may have greater capacity adopt monetary transparency, not least given stronger societal support for inflation control in these contexts (e.g., Mishkin 2004; Batini and Laxton 2006).

[20] `https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups`.

main results are not driven by industrialised economies. In addition, my findings indicate that statistical significance for reforms in communication policy is higher (the standard errors are lower) in this additional sample. This suggests that transparency is particularly effective in promoting credibility in emerging markets, which is relevant for existing debates about monetary credibility in developing countries (IMF 2018).

Additional robustness checks. In appendix 4.H, I drop all countries which have experienced changes in transparency and central bank statute in the same year; these tests controls for those cases in which variations in communication have not been driven directly by monetary authorities, as indicated in the theory discussed in section 4.2. In appendix 4.I, I control for institutional variables, including levels of democracy and checks and balances within the government, which previous contributions have shown being strong predictors of CBI and its effects (Acemoglu et al. 2008; Bodea and Hicks 2015). In appendix 4.J, I use country-specific linear time trends (e.g., Wing, Simon, and Bello-Gomez 2018) and repeat the analysis restricting the sample to observations prior to 2008 to account for the use of communication as a tool for managing expectations at low levels of policy rates (e.g., Hansen and McMahon 2016b). In all cases, results are analogous to those discussed above, suggesting the main findings are robust to alternative specifications.

4.5 Conclusions

The main idea underlying this paper is that transparency matters for the ability of delegated central banks to attain low and stable inflation. I also argue that, to be effective, public communication must be supported by an institutional framework granting autonomy to monetary authorities, so that central bank transparency and independence should be understood as complementary policy instruments. The empirical results strongly support this view. Focusing short-term changes in inflation following reforms in transparency, I provide systematic evidence of an effect of transparency on inflation outcomes. Inflation is significantly lower in response to an increase in the amount of information provided by monetary authorities; in addition, this effect is stronger when pre-existing levels of de jure CBI are higher.

The study contributes to the study of central bank communication. In particular, it confirms that transparency has a positive effect of transparency on credibility, as of-

ten suggested in the literature (Geraats 2002; Adrian, Laxton, and Obstfeld 2018a). I suggest that, when the level policymakers' inflation tolerance is uncertain, additional communication can be used to demonstrate that monetary authorities are committed to low inflationary policies. This is arguably relevant for considerations related to the determinants of monetary credibility (IMF 2018; Al-Mashat et al. 2018a), particularly in contexts where central banks are called to manage additional policy functions such as financial stability tasks (Nier et al. 2012; Kamber, Karagedikli, Smith, et al. 2015).

The analysis has also implications for the large literature on central bank independence. In line with expectations, I find strong policy interactions between CBI and transparency. The main implication is that communication is helpful to reinforce the credibility embedded in central bank laws. I also show that –at least in the sample considered- CBI without transparency does not significantly affect price dynamics. The latter finding appears to run against the long-held view that legal independence helps managing expectations (e.g., Drazen 2000, ch. 5), although it is in line with previous empirical studies on the topic (e.g., Campillo and Miron 1997; Cukierman, Web, and Neyapti 1992; Acemoglu et al. 2008). In this respect, communication should be considered an important aspect of monetary delegation.

Although the empirical results presented above robust to several sensitivity checks, refinements of the analysis are certainly possible. First of all, the study could be extended to the use of higher frequency (for example, quarterly) data to better distinguish the role of transparency on inflation. Secondly, it could be interesting to examine the impact of changes in communication on different variables, for example output. To the extent that transparency enables the public to form more accurate expectations of central banks' decisions, we should not expect any significant effect on this variable. Addressing this point would allow to assess whether the additional anti-inflationary credibility impairs central banks' ability to pursue additional objectives, such as output stabilisation (Batini and Laxton 2006). Most importantly, the analysis could be extended to separate different communication policies. This is relevant given that the binary variable for reforms in transparency used in this paper does not directly distinguish among different forms of transparency (for example, economic forecasts as opposed to data used in the decision-making process).

Looking forward, it will be possible to follow the example of inflation targeting considered is section 4.4 and evaluate separately the effects of different forms of communication. Examining how different aspects of central bank transparency influence

expectations and how this effect interacts with broader structures of monetary delegation constitutes an interesting area for future research.

Appendix

4.A Proofs

4.A.1 Proof of Proposition 1

Given that $\pi = m - u$, $y = \pi - \pi^E$ and $E[\pi|m] = (1 - k_1)m - k_0$, the central bank's payoff can be rewritten as:

$$U_{CB} = -\frac{1}{2}(m - u)^2 + \gamma\big(m - u - (1 - k_1)m + k_0\big). \tag{4.16}$$

The first derivative of equation (4.16) with respect to m is given by

$$\frac{\partial U_{CB}}{\partial m} = -m + u + \gamma k_1.$$

The first order condition corresponds to $m(u, \gamma) = \gamma k_1 + u$. The second derivative of (4.16) is always negative ($\frac{\partial^2 U_{CB}}{\partial m} < 0$), so that the equilibrium condition is a maximum of the CB's payoffs. This gives the choice of the monetary instrument of the central bank expressed in equation (4.8) in Section 4.2.1.

To derive the expression for the expected value of the public's posterior concerning the shock u, recall that $m(u, \gamma) = (1 - \alpha) + \theta$. Given that $\theta \sim \mathcal{N}(\mu_\theta, \sigma_\theta^2)$ and $u \sim \mathcal{N}(\mu_u, \sigma_u^2)$, the monetary instrument is also distributed normally

$$m(u, \gamma) \sim \mathcal{N}\Big((1 - \alpha + \mu_\theta)k_1 + \mu_u, k_1^2\sigma_\theta^2 + \sigma_u^2\Big).$$

The posterior value for $E[u|m]$ expressed in equation (4.9) in the Section 4.2.1 can now be written by means of the normality definition for the distributions of u and m, so

that

$$E[u|m] = \frac{\sigma_u^2}{\sigma_u^2 + k_1^2\sigma_\theta^2} m + \mu_u - \frac{\sigma_u^2}{\sigma_u^2 + k_1^2\sigma_\theta^2}\Big((1 - \alpha + \mu_\theta)k_1 + \mu_u\Big).$$

The above expression for $E[u|m]$ has the same form of the public's conjecture $E[u|m] = k_1 m + k_0$; to get identity we require:

$$k_1 = \frac{\sigma_u^2}{\sigma_u^2 + k_1^2\sigma_\theta^2} \tag{4.17}$$

$$k_0 = \mu_u - \frac{\sigma_u^2}{\sigma_u^2 + k_1^2\sigma_\theta^2}\Big(k_1(1 - \alpha + \theta) + \mu_u\Big) \tag{4.18}$$

To analyse possible solutions to the above equations, we define the function:

$$F(k_1) = \sigma_\theta^2 k_1^3 + \sigma_u^2 k_1 - \sigma_u^2. \tag{4.19}$$

The solutions of $F(k_1) = 0$ are the solutions to (4.17).

If we define $a = \frac{\sigma_u^2}{\sigma_\theta^2} > 0$, it is possible to express function (4.19) as $F(k_1) = k_1^3 + ak_1 - a$. The first derivative of $F(k_1)$, $F'(k_1) = 3k_1^2 + a$, is always positive; therefore, $F(k_1)$ is continuous function monotonically increasing in $\mathbb{R}$. In addition $F(0) = -a < 0$ and $F(1) = 1 > 0$, so for any value of the parameters σ_u^2 and σ_θ^2, function $F(k_1)$ and function (4.19) have one (and only one) real root comprised in $(0, 1)$.

Denote with k^* the solution to (4.17). It is now possible to rewrite k_0 as

$$k_0 = \mu_u - k^*\Big(k^*(1 - \alpha + \theta) + \mu_u\Big).$$

The partial derivative of $F(k_1)$ with respect to k_1 is $3k_1^2\sigma_\theta^2 + \sigma_u^2 \neq 0$, which makes it possible to use the implicit function theorem to see how k^* varies according to transparency. Applying the theorem to equation (4.19), we have that:

$$\frac{\partial k_1(\sigma_u^2)}{\partial \sigma_u^2} = -\frac{\frac{\partial F(k_1)}{\partial \sigma_u^2}}{\frac{\partial F(k_1)}{\partial k_1}} = -\frac{k_1 - 1}{3k_1^2\sigma_\theta^2 + \sigma_u^2}. \tag{4.20}$$

The sign of the derivative is always positive for $0 < k_1 < 1$. Therefore, for all possible values of k^*, higher transparency (lower σ_u^2) implies lower values of k^*.

To analyse how this affects the payoffs of the central bank, we can substitute k^* into the central bank's response and then into the values of inflation and output. As indicated

in equation (4.11), realised inflation is

$$\pi = m(u, \gamma) - u = \gamma k^*.$$

Realised output, in turn, is given by:

$$\begin{aligned} y &= \pi - \pi^E = \gamma k^* - (1 - k^*) + k_0 \\ &= k^* \Big(k^*(\theta - \mu_\theta) + (\mu_u - u) \Big) + (\mu - u), \end{aligned} \tag{4.21}$$

as indicated in equation (4.12).

Substituting these values into the central bank's objective $U_{CB} = -\frac{1}{2}(\pi)^2 + \gamma y$ we obtain monetary authorities' payoffs, as reported in equation (4.13):

$$U_{CB} = -\frac{1}{2}(\gamma k^*)^2 + \gamma \Big((k^*)^2(\theta - \mu_\theta) + k^*(\mu_u - u) + \mu_u - u \Big).$$

For the central bank to be willing to adopt greater transparency, these payoffs must be higher under a communication policy $\tau = H$. Denote as k^*_τ the value of the updating coefficient k^* corresponding to communication policy $\tau \in \{H, L\}$. The condition for the adoption of high transparency can be expressed as:

$$\begin{aligned} -\frac{1}{2}(\gamma k^*_H)^2 + \gamma \Big((k^*_H)^2(\theta - \mu_\theta) + k^*_H(\mu_u - u) + \mu_u - u \Big) \geq \\ -\frac{1}{2}(\gamma k^*_L)^2 + \gamma \Big((k^*_L)^2(\theta - \mu_\theta) + k^*_L(\mu_u - u) + \mu_u - u \Big) \end{aligned} \tag{4.22}$$

By condition (4.20), we have that $k^*_H < k^*_L$. Solving (4.22) for θ, we obtain:

$$\begin{aligned} (k^{*2}_H - k^{*2}_L) \Big(\frac{1}{2}\theta - \mu_\theta + \frac{1}{2}(\alpha - 1) \Big) \geq (k^*_L - k^*_H)(\mu_u - u) \\ \Leftrightarrow \\ \theta \leq 2 \Big(\mu_\theta - \frac{1}{2}(\alpha - 1) + \frac{\mu_u - u}{k^*_H + k^*_L} \Big) \equiv \bar{\theta}. \end{aligned} \tag{4.23}$$

As a result, the central bank opts for a policy of high transparency $\tau = H$ if $\theta < \bar{\theta}$.

Finally, it is possible to study the impact of greater transparency on inflation. Realised inflation is given by $\pi = \gamma k^* = (1 - \alpha + \theta)k^*$, where k^* solves equation (4.19).

Hence, inflation is implicitly defined by $\pi(k_1) = \gamma(\sigma_\theta^2 k_1^3 + \sigma_u^2 k_1 - \sigma_u^2)$. Using the expression for the derivative of k_1 reported in (4.20), we obtain:

$$\frac{\partial \pi(\sigma_u^2)}{\partial \sigma_u^2} = -(1 - \alpha + \theta)\frac{k_1 - 1}{3k_1^2\sigma_\theta^2 + \sigma_u^2}. \tag{4.24}$$

Therefore, for all possible values of k^*, higher transparency (lower σ_u^2) implies lower inflation. ■

4.A.2 Proof of Proposition 2

The proof follows on from Proposition 1. If $\theta < \bar{\theta}$, the central bank opts for $\tau = H$. As noted, realised inflation is given by $\pi = \gamma k^* = (1 - \alpha + \theta)k^*$. We have that

$$\frac{\partial \pi(\gamma)}{\partial \gamma} = -k^* < 0$$

given that $k^* > 0$, as shown by the solution found for equation (4.19). This indicates that π depends negatively on both α and k^*. ■

4.B Alternative assumptions

4.B.1 Public observes autonomy

Suppose that the public observes $\gamma = 1-\alpha$; in this case, there is no uncertainty concerning the policymakers' inflation tolerance. Upon observing $m = \gamma + u$, the private sector infers that $u = m - \gamma$; accordingly, it anticipates a level of inflation $\pi = m - u = \gamma$.

4.B.2 Public sets expectations before observing the policy

If the public sets π^E before observing m, the policy has no impact on how expectations are formed. The CB then chooses m so as to maximise the payoff function (4.3). This implies implying a level of inflation $\pi = m - u = \gamma$. In this case, the public rationally anticipates a level of inflation $\pi = E[\gamma] = (1 - \alpha) + \mu_\theta$.

4.B.3 The central bank has a positive inflation target

Consider a positive inflation target $\pi^* > 0$. The central bank's payoff function is now represented by $U_{CB} = -\frac{1}{2}(\pi - \pi^*)^2 + \gamma y$. The best response of the central bank is given by $m(u, \gamma, \pi^*) = \pi^* + \gamma k_1 + u$. Using the same reasoning presented in appendix 4.A.1, in this case realised inflation is equal to $\pi = \pi^* + \gamma k^*$ (cf. Frankel and Kartik 2015, 9).

4.C The Dincer-Eichengreen indicator of transparency

This appendix reports the five components of the Dincer-Eichengreen indicator of transparency, as described in Dincer and Eichengreen (2007, 22-26; 2009). The final index is the sum of the scores obtained from the questions listed below (min. = 0, max. = 15).

1. *Political Transparency*. Openness about policy objectives. It comprises a formal statement of objectives, including an explicit prioritization in case of multiple goals, a quantification of the primary objective(s), and explicit institutional arrangements.

    - Is there a formal statement of the objective(s) of monetary policy, with an explicit prioritization in case of multiple objectives?

      No formal objective(s) = 0; Multiple objectives without prioritization = 1/2; One primary objective, or multiple objectives with explicit priority = 1.

    - Is there a quantification of the primary objective(s)?

      No = 0. Yes = 1.

    - Are there explicit contacts or other similar institutional arrangements between the monetary authorities and the government?

      No central bank contracts or other institutional arrangements = 0; Central bank without explicit instrument independence or contract = 1/2; Central bank with explicit instrument independence, although possibly subject to an override procedure = 1.

2. *Economic Transparency*. Refers to the economic information that is used for monetary policy. This includes economic data, the model of the economy that the central bank employs to construct forecasts or evaluate the impact of its decisions, and the internal forecasts (model based or judgmental) that the central bank relies on.

    - Is the basic economic data relevant for the conduct of monetary policy publicly available? (The focus is on the following five variables: money supply, inflation, GDP, unemployment rate and capacity utilization.)

Quarterly time series for at most two out of the five variables = 0. Quarterly time series for three or four out of the five variables = 1/2. Quarterly time series for all five variables = 1.

- Does the central bank disclose the macroeconomic model(s) it uses for policy analysis?

  No = 0. Yes = 1.

- Does the central bank regularly publish its own macroeconomic forecasts?

  No numerical central bank forecasts for inflation and output = 0. Numerical central bank forecasts for inflation and/or output published at less than quarterly frequency = 1/2. Quarterly numerical central bank forecasts for inflation and output for the medium term (one to two years ahead), specifying the assumptions about the policy instrument (conditional or unconditional forecasts) = 1.

3. *Procedural Transparency* Information about the way monetary policy decisions are taken.

   - Does the central bank provide an explicit policy rule or strategy that describes its monetary policy framework?

     No = 0. Yes = 1.

   - Does the central bank give a comprehensive account of policy deliberations (or explanations in case of a single central banker) within a reasonable amount of time? No or only after a substantial lag (more than eight weeks) = 0.

     Yes, comprehensive minutes (although not necessarily verbatim or attributed) or explanations (in case of a single central banker), including a discussion of backward and forward-looking arguments = 1.

   - Does the central bank disclose how each decision on the level of its main operating instrument or target was reached?

     No voting records, or only after substantial lag (more than eight weeks) = 0. Non-attributed voting records = 1/2. Individual voting records, or decision by single central banker = 1.

4. *Policy Transparency*. Refers to prompt disclosure of policy decisions, together with an explanation of the decision, and an explicit policy inclination or indication of likely future policy actions.

    - Are decisions about adjustments to the main operating instrument or target announced promptly?

      No or only after the day of implementation = 0. Yes, on the day of implementation = 1.

    - Does the central bank provide an explanation when it announces policy decisions?

      No = 0. Yes, when policy decisions change, or only superficially = 1/2. Yes, always and including forwarding-looking assessments = 1.

    - Does the central bank disclose an explicit policy inclination after every policy meeting or an explicit indication of likely future policy actions (at least quarterly)?

      No = 0. Yes = 1.

5. *Operational Transparency*. Concerns the implementation of the central bank's policy actions. It involves a discussion of control errors in achieving operating targets and (unanticipated) macroeconomic disturbances that affect the transmission of monetary policy. Furthermore, the evaluation of the macroeconomic outcomes of monetary policy in light of its objectives is included here as well.

    - Does the central bank regularly evaluate to what extent its main policy operating targets (if any) have been achieved?

      No or not very often (at less than annual frequency) = 0. Yes but without providing explanations for significant deviations = 1/2. Yes, accounting for significant deviations from target (if any); or, (nearly) perfect control over main operating instrument/target = 1.

    - Does the central bank regularly provide information on (unanticipated) macroeconomic disturbances that affect the policy transmission process?

      No or not very often = 0. Yes but only through short-term forecasts or analysis of current macroeconomic developments (at least quarterly) = 1/2. Yes including a discussion of past forecast errors (at least annually) = 1.

- Does the central bank regularly provide an evaluation of the policy outcome in light of its macroeconomic objectives?

  No or not very often (at less than annual frequency) = 0. Yes but superficially = 1/2. Yes, with an explicit account of the contribution of monetary policy in meeting the objectives = 1.

4.D Full sample

Table 4.D.1: List of countries and reforms in transparency

Country	Average transparency[21]	Communication reforms[22]
Albania	6.33	2003,2007
Argentina	5.38	
Armenia	7.70	2006,2010
Australia	9.25	2002,2008
Bahrain	3.75	
Bangladesh	3.50	2003
Belarus	4.25	
Bhutan	2.92	
Botswana	5.60	
Brazil	6.90	1999,2000,2010
Bulgaria	5.04	
Cambodia	2.42	
Canada	10.79	
Chile	7.12	2009
China	2.92	
Colombia	6.21	1999,2000,2007
Croatia	3.06	
Cyprus	7.33	2002
Czech Republic	11.83	
Denmark	6.38	2003,2007
Egypt	3.00	2005,2006
El Salvador	2.62	2001

[21] Average of Dincer and Eichengreen (2014) indicator of central bank transparency.

[22] Defined as an annual increase in the Dincer and Eichengreen (2014) indicator of central bank transparency, exceeding two standard deviations the sample average for the country.

(continued)

Country	Average transparency	Communication reforms
Estonia	5.70	2006
Fiji	3.69	
Georgia	4.67	
Ghana	5.21	
Guatemala	4.54	
Guyana	1.67	
Hungary	9.71	
India	2.42	2006
Indonesia	7.00	
Iran	3.75	
Iraq	1.75	
Israel	9.88	
Jamaica	5.38	
Japan	9.00	2008
Jordan	1.55	
Kazakhstan	5.38	2005
Kenya	5.10	2001,2006,2007
Korea, Republic of	8.55	2000,2010
Kuwait	2.25	2005
Kyrgyzstan	4.58	2001,2004
Laos	1.45	
Latvia	7.64	2006
Lebanon	1.50	
Lesotho	6.00	
Libya	1.75	
Lithuania	5.25	
Macedonia	6.00	
Malawi	2.75	

(continued)

Country	Average transparency	Communication reforms
Malaysia	5.88	2000
Mauritius	6.00	
Mexico	5.42	2004
Moldova	6.20	2001
Mongolia	3.83	2001,2002,2008
Mozambique	4.81	2009
Namibia	6.89	2004,2005,2009
New Zealand	13.79	1999
Nigeria	5.10	
Norway	8.48	2001,2006,2007
Oman	2.46	
Pakistan	3.71	2004,2005,2010
Papua New Guinea	3.25	
Peru	7.60	2001,2002,2009
Philippines	8.58	1999,2001,2002,2010
Poland	7.54	1999,2001,2005,2006,2007
Qatar	2.92	
Romania	5.42	
Russian Federation	2.38	2004
Rwanda	2.16	
Saudi Arabia	1.38	2008
Sierra Leone	1.40	2007
Singapore	4.89	
Slovakia	5.31	2002,2006
Slovenia	6.56	
Solomon Islands	1.50	
South Africa	9.00	2001
Sri Lanka	6.00	

(continued)

Country	Average transparency	Communication reforms
Sudan	2.12	2007
Sweden	14.33	2000,2002
Switzerland	8.70	
Syria	0.50	
Tajikistan	2.58	2004,2005
Tanzania	2.25	2002
Thailand	6.40	
Tunisia	4.55	
Turkey	9.00	
Uganda	3.10	
Ukraine	3.12	2002
United Kingdom	12.29	1999
United States of America	10.68	2006
Uruguay	3.91	
Venezuela	3.38	
Yemen	2.00	
Zambia	1.45	2005

4.E Emerging markets

Table 4.E.1: Effect of discrete changes in transparency on inflation: Emerging markets

	Log of annual CPI inflation			
	OLS			
	(1)	(2)	(3)	(4)
Transparency reform (t)	-0.287^{**}	-0.301^{**}	0.638	0.726^{*}
	(0.131)	(0.135)	(0.417)	(0.413)
CBI			0.055	-0.175
			(0.812)	(0.783)
Transparency reform (t) $\times$ CBI			-1.659^{*}	-1.838^{**}
			(0.878)	(0.859)
CPI inflation ($t-1$)	0.243^{***}	0.194^{***}	0.250^{***}	0.198^{***}
	(0.055)	(0.049)	(0.055)	(0.049)
Controls		Yes		Yes
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	626	626	626	626
R^2 (within)	0.194	0.231	0.207	0.247
F Statistic	10.098	9.031	9.430	8.817

Note: *p<0.1; **p<0.05; ***p<0.01

Emerging markets are identified using World Bank Country and Lending Groups classification, dropping 'high income' economies from the sample.
Transparency reform is equal to 1 in years in which the Dincer-Eichengreen indicator exceeds 2 standard deviations the average annual change for the country, and 0 otherwise. Control variables are lagged values of: (i) de facto exchange rate flexibility; (ii) import-export as share of GDP (iii) GDP growth (iv) logarithm of GDP per capita; (v) fiscal deficit. Standard errors clustered by country reported in parentheses.

4.F Inflation targeting countries

Table 4.F.1: Inflation targeting, individual impact and interaction with CBI

	Log of annual CPI inflation			
	OLS			
	(1)	(2)	(3)	(4)
Inflation targeting adoption	−0.182	−0.182	0.395**	0.433***
	(0.208)	(0.208)	(0.173)	(0.155)
CBI			0.049	−0.069
			(0.526)	(0.509)
Inflation targeting adoption × CBI			−0.869*	−0.903*
			(0.485)	(0.474)
CPI inflation ($t-1$)	0.241***	0.241***	0.242***	0.214***
	(0.046)	(0.046)	(0.046)	(0.042)
Controls		Yes		Yes
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	876	876	876	876
R^2 (within)	0.207	0.207	0.208	0.228
F Statistic	15.380	15.380	13.410	11.265
Note:				*p<0.1; **p<0.05; ***p<0.01

Inflation targeting adoption equals 1 in years in which monetary authorities in a country announced a target, and 0 otherwise. The classification of inflation targeting economies is obtained from Roger (2009) and Hammond (2012) Control variables are lagged values of: (i) de facto exchange rate flexibility; (ii) import-export as share of GDP (iii) GDP growth (iv) logarithm of GDP per capita; (v) fiscal deficit. Standard errors clustered by country reported in parentheses.

4.G Individual effect of CBI

Table 4.G.1: Variations in inflation in response to change in CBI only

	Log of annual CPI inflation			
	OLS			
	Including CBI only		Including CBI and transparency	
	(1)	(2)	(3)	(4)
Transparency reform (t)			-0.192^{*}	-0.212^{**}
			(0.098)	(0.101)
CBI	0.011	-0.106	0.046	-0.072
	(0.530)	(0.513)	(0.531)	(0.515)
Controls		Yes		Yes
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	876	876	876	876
R^2 (within)	0.206	0.226	0.211	0.233
F Statistic	15.282	12.379	14.694	12.201
Note:				*p<0.1; **p<0.05; ***p<0.01

Inflation targeting adoption equals 1 in years in which monetary authorities in a country announced a target, and 0 otherwise. Control variables are lagged values of: (i) de facto exchange rate flexibility; (ii) import-export as share of GDP (iii) GDP growth (iv) logarithm of GDP per capita; (v) fiscal deficit. Standard errors clustered by country reported in parentheses.

4.H Restricted sample

Table 4.H.1: Effect of discrete changes in transparency, excluding simultaneous changes in CBI and communication policy

	Log of annual CPI inflation			
	OLS			
	(1)	(2)	(3)	(4)
Transparency reform (t)	-0.180^{*}	-0.204^{**}	0.367	0.383
	(0.098)	(0.101)	(0.289)	(0.297)
CBI			0.669	0.604
			(0.762)	(0.700)
Transparency reform (t) $\times$ CBI			-1.008^{*}	-1.080^{*}
			(0.577)	(0.587)
CPI inflation ($t-1$)	0.269^{***}	0.240^{***}	0.274^{***}	0.245^{***}
	(0.051)	(0.049)	(0.050)	(0.048)
Controls		Yes		Yes
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	628	628	628	628
R^2 (within)	0.237	0.261	0.246	0.272
F Statistic	12.999	10.611	11.842	10.047
Note:				*p<0.1; **p<0.05; ***p<0.01

The models report results for a restricted sample, obtained after excluding cases in which a country has experienced changes in central bank statute and communication policy in the same year.

Transparency reform is equal to 1 in years in which the Dincer-Eichengreen indicator exceeds 2 standard deviations the average annual change for the country, and 0 otherwise. Control variables are lagged values of: (i) de facto exchange rate flexibility; (ii) import-export as share of GDP (iii) GDP growth (iv) logarithm of GDP per capita; (v) fiscal deficit. Standard errors clustered by country eported in parentheses.

4.I Institutional variables

Table 4.I.1: Effects of changes in transparency, controlling for institutional factors

	Log of annual CPI inflation			
	OLS			
	Democracy		Checks and balances	
	(1)	(2)	(3)	(4)
Transparency reform (t)	-0.212^{**}	0.336	-0.206^{**}	0.351
	(0.100)	(0.297)	(0.101)	(0.297)
CBI		-0.072		-0.016
		(0.529)		(0.504)
Transparency reform (t) $\times$ CBI		-1.000^{*}		-1.019^{*}
		(0.593)		(0.596)
Democracy (Polity IV)	0.014	0.014		
	(0.015)	(0.015)		
Checks and balances (DPI)			-0.001^{***}	-0.001^{***}
			(0.0002)	(0.0002)
CPI inflation ($t-1$)	0.207^{***}	0.211^{***}	0.218^{***}	0.222^{***}
	(0.041)	(0.041)	(0.043)	(0.042)
Controls		Yes		Yes
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	872	872	859	859
R^2 (within)	0.231	0.238	0.252	0.259
F Statistic	12.010	11.224	13.236	12.352
Note:				*p<0.1; **p<0.05; ***p<0.01

Democracy is measured using the *Polity2* scale in the PolityIV dataset (Marshall, Jaggers, and Gurr 2002). Political checks and balances are measured using the Checks Lax variable in the Database of Political Institutions (Keefer 2012).
Transparency reform is equal to 1 in years in which the Dincer-Eichengreen indicator exceeds 2 standard deviations the average annual change for the country, and 0 otherwise. Control variables are lagged values of: (i) de facto exchange rate flexibility; (ii) import-export as share of GDP (iii) GDP growth (iv) logarithm of GDP per capita; (v) fiscal deficit. Standard errors clustered by country reported in parentheses.

4.J Alternative time trends and pre-2008 sample

Table 4.J.1: Effects of discrete changes in transparency, controlling for linear time trends and the financial crisis

	Log of annual CPI inflation			
	OLS			
	Country time trends		Only observations before 2008	
	(1)	(2)	(3)	(4)
Transparency reform (t)	-0.238^{***}	0.184	-0.240^{***}	0.247
	(0.075)	(0.225)	(0.085)	(0.262)
CBI		-0.364		-0.207
		(0.478)		(0.442)
Transparency reform (t) $\times$ CBI		-0.765^{**}		-0.880^{*}
		(0.386)		(0.449)
CPI inflation ($t-1$)	-0.007	-0.005	0.173^{***}	0.187^{***}
	(0.035)	(0.035)	(0.037)	(0.037)
Country-specific time trends (linear)	Yes	Yes		
Controls			Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	876	876	641	641
R^2 (within)	0.439	0.442	0.129	0.128
F Statistic	4.973	4.943	5.242	4.877
Note:				*p<0.1; **p<0.05; ***p<0.01

Inflation targeting adoption equals 1 in years in which monetary authorities in a country announced a target, and 0 otherwise. Control variables are lagged values of: (i) de facto exchange rate flexibility; (ii) import-export as share of GDP (iii) GDP growth (iv) logarithm of GDP per capita; (v) fiscal deficit. Ordinary standard errors reported in parentheses.

Chapter 5

Conclusions

The dissertation studies the dynamics of communication, transparency and accountability in the context of central banks. Specifically, it examines the following questions:

1. Does legislative oversight affect the transparency of monetary committees?
2. How do elected politicians conduct legislative oversight of monetary policymakers, and how does oversight vary across different policy areas?
3. How does transparency interact with central bank delegation in promoting the credibility of independent central banks?

These questions are addressed in three papers corresponding to chapters 2, 3 and 4 of thesis. The findings outlined in the three chapters suggest that communication plays an important role in strengthening the accountability and credibility of monetary authorities. In Chapter 2, I investigate the impact of legislative oversight on the transparency of the Federal Open Market Committee. I suggest that, although communication may impose costs on the organisations, it also entails benefits in terms of managing political pressures. A testable implication of this argument is that the amount of information disclosed by policymakers should increase in response to higher political scrutiny. Actual patterns of communication and transparency within the FOMC strongly supports this expectation. Using methods from computational linguistics and routines of parliamentary oversight of the Fed in US Congress, I find that the committee discloses additional information in its minutes when the legislative scrutiny of its decisions is likely to increase. In doing so, the paper provides first empirical evidence of a direct link between political oversight, transparency and central banks' accountability.

These aspects of communication are further explored in Chapter 3, which examines dynamics of legislative oversight of economic policy within the UK parliament. Using several automated content analysis methods, the paper finds consistent differences in deliberative styles between monetary and fiscal policy, as well as across chambers (Commons, Lords). Parliamentarians appear more willing to engage in reciprocal exchange of arguments in the context of monetary policy oversight than in the context of fiscal policy hearings. The paper also suggests some degree of cross-partisan agreement in challenging the officials of the Bank of England on issues related to governance and transparency, reinforcing the idea that these aspects of monetary policy matter for central banks' accountability. Building on this, Chapter 4 investigates a different dimension of communication, namely the relationship between transparency and independence in promoting the credibility of monetary authorities. In the study, I build on a Barro-Gordon framework to show that communication and central bank independence should be considered complementary policy instruments. I then test this argument using panel data for 95 countries in the period from 1998 to 2010. I uncover a negative correlation between transparency and inflation. In line with expectations, I also find a negative interaction effect between legal independence and transparency in driving inflation trends within countries, while monetary delegation alone appears to have little impact on prices. This suggests that transparency affects the ability of delegated monetary authorities to commit to stable inflation.

As outlined in the introductory chapter of the thesis, the above results contribute to several strands of the literature. These include the relationship between transparency and accountability within public sector agencies, theories of delegation, and central bank communication. In this conclusive chapter, I first consider the implications of the findings for future research. Building on this, I discuss the contributions to current debates on central bank policy and bureaucratic delegation.

Implications for future research

A first interesting question for future research would be to explore in greater detail the institutional mechanisms underlying agencies' transparency. The theoretical analysis presented in Chapter 2 could be extended to include more than two types of organisations, thus allowing for a better understanding of agencies' competence, or to allow some effort in the acquisition of information before an organisation takes policy de-

cisions. In addition, it would be possible to consider the impact of different costs of communications according to agencies' competence.

From an empirical perspective, it would be interesting to study whether the findings discussed in Chapter 2 apply to different types of organisations. A limited number of existing papers suggest that this is the case. For example, the analysis of voluntary accountability provisions among Dutch local governments discussed by Koop (2014) and the study of the communication behaviour of the Israeli financial regulator presented by Gilad, Maor, and P. Bloom (2013) are both consistent with the argument presented in Chapter 2. In those instances, as in the case of the FOMC discussed in the dissertation, the disclosures of delegated agencies appear to increase in response to the public salience of their decisions. It would be interesting to investigate whether similar considerations apply to different areas of government.

The analysis of parliamentary oversight presented in Chapter 3 could also be extended in several directions. For example, it would be possible to restrict the analysis to focus on specific events which we may have expected to increase the political salience of policymakers' decisions. One possibility would be to study variations in the content of oversight after the launch of unconventional monetary policies to understand how dynamics of oversight of Bank of England's officials have changed after these events. This would further advance current understandings of how politicians conduct oversight of monetary authorities. Political incentives in the context of parliamentary oversight could also be investigated in greater detail. One possibility would be to study how arguments used by politicians in oversight hearings correspond to parties' stance on specific issues, as reported for example in party manifestoes. Such an analysis would help deriving clearer indications concerning the effect of partisanship on legislative oversight.

Finally, while the thesis focuses principally on the political dimension of central bank transparency, the results discussed provide also suggestions for further research on its economic impact. In this respect, it would be useful to research in greater detail the potential costs of increasing the information provided by monetary committees as a result of accountability considerations. An interesting question is whether additional information provided to the public in moments of greater scrutiny favour economic agents' understanding of policy decisions, or whether instead it contributes to greater economic volatility. A partial answer to this question comes from Chapter 4 of the thesis, where I suggest that increasing the transparency of monetary decisions has a positive effect on credibility. This finding indicates that communication reinforce the

efficiency of monetary policy decisions. The analysis could be extended to study the impact of different communication policies; doing so would arguably help evaluating which forms of transparency are most effective for policy.

Policy implications

The thesis has several additional implications for actual policymaking, especially related to central bank governance, credibility, and the institutional design of public institution. To conclude the dissertation, it is useful to consider how the findings outlined in the previous three chapters contribute ongoing debates in these areas.

A first implication, already mentioned in the introductory chapter, is to relate central banks' communication behaviour to their public accountability. While often advocated by senior policymakers (e.g., Blinder 1998; Bernanke 2004; Yellen 2013), this function of transparency has received little attention in the empirical literature. One of the main contributions of the thesis is to study systematically the relationship between the transparency of monetary authorities and dynamics of political supervision. I have suggested that central banks tend to actively communicate their decisions to elected representatives. This, in turn, implies a positive link between transparency and political oversight. The main implication is that communication can be used to promote the public accountability of monetary policymakers.

These considerations are likely even more important given on-going institutional changes in central bank policy, particularly with respect to the diffusion of financial stability mandates and unconventional monetary policies. As noted by several scholars, these instruments have redistributive implications which are typically stronger than those involved in interest rate management (e.g., Bean 2015; 2018). As a result, they may raise political pressures on monetary authorities in the future (Kohn 2013; Goodhart and Lastra 2018; Rajan 2019). My research suggests that, in these circumstances, a transparent communication policy can represent a useful way to manage an adverse political environment. Such considerations seem especially relevant given the unprecedented stimulus programs approved by several central banks in response to the COVID-19 pandemic in early 2020, which at the time of writing are attracting increasing public scrutiny.[1]

[1]For example, commenting on the Federal Reserve's decisions to support high-yield bond markets through asset purchases, the editorial board of the Financial Times notes that "[t]he politics of this support

Additional implications of the thesis concern central bank policy more narrowly defined. In particular, Chapter 4 suggests that transparency may be a useful way to limit uncertainties about how policymakers' actions are expected to map into inflation outcomes. Again, this finding appears relevant in a context where central banks are increasingly assuming policy functions that differ from interest rate management. Focusing on financial stability, for example, some authors suggest that the adoption of macroprudential policy functions raise the need to clarify how these additional functions interact with price stability mandates (Nier et al. 2012; Kamber, Karagedikli, Smith, et al. 2015). Others have raised questions as to whether large purchases of government bonds, as deployed by several central banks in early 2020, can impair central banks' ability to manage inflationary pressures in the future (e.g., Blanchard and Pisani-Ferry 2020; Miles and Scott 2020; Yashiv 2020). While the thesis does not directly address these issues, it does suggest that additional communication might be useful to manage expectations in future, especially if price stability becomes a greater concern.

Most importantly, the dissertation has several implications for debates about policy delegation. As noted in the introductory chapter, a key concern in granting legal autonomy to public organisations is that they may acquire too much discretion (e.g., Stasavage 2003). This suggests a trade-off between policy efficiency, which may be higher under delegation, and democratic accountability (Majone 1999; 2014). The dissertation suggests that political oversight and transparency can mitigate this problem. If elected politicians set up procedures to ensure timely release of information related to organisations' decisions –along with laws that protect their legal autonomy- it will be easier for the legislature to monitor agencies' policies. This could also make delegation politically more acceptable. In this respect, the thesis provides empirical support to the idea that communication and oversight favour democratic accountability (McCubbins and Schwartz 1984; McCubbins, Noll, and Weingast 1989).

Finally, the thesis offers new ways to think about transparency within the public sector. Advocates of greater openness often describe public disclosures as a necessary –and sometimes sufficient- condition to ensure accountability and democratic respon-

are terrible. Public anger accompanied bailouts for the banks during the financial crisis; supporting the junk bond market may be even more controversial." ("Fed's junk bond purchases should be short-term", *Financial Times*, 17 April 2020). The decision of the FOMC to buy municipal bonds for 500$ billion to states and large cities but not smaller municipalities has also attracted public scrutiny, see for example "Federal Reserve faces blowback over plan to back some cities over others" by Colby Smith and Patrick Temple-West, *Financial Times*, 14 April 2020.

siveness of public organisations (McCubbins, Noll, and Weingast 1987; Stiglitz 1999; Florini 2007). Sceptics, in turn, argue that public scrutiny does not affect agencies' communication efforts, and that excessive disclosures may in fact be counterproductive for policy purposes (Stasavage 2004; Hood and Heald 2006; Hood 2010a). The view I put forward in this thesis differs from both perspectives. In line with a positive understanding of transparency, I provide empirical evidence that communication is related to public accountability. Nevertheless, I also acknowledge that agencies retain control over the information they reveal and that excessive disclosures may have repercussions for policy. This implies that structures of political oversight are necessary to evaluate the content and quality of the information released by public organisations. Considering these different aspects of communication will be arguably important when evaluating whether to delegate policy to autonomous institutions in the future.

The fundamental message of the thesis is that transparency is an important driver of accountability and that it contributes to the democratic legitimacy of public organisations. To work in this direction, however, communication must be associated to mechanisms of oversight that allow elected representatives to evaluate information provided by public officials. Merely requesting information from delegated organisations does not automatically make them more accountable; politicians and members of the public must also engage with agencies' accounts in a mutual process of deliberation. Genuine transparency requires both revealing information and paying attention to it.

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